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ABSTRACT

Training after high school in the United States was studied to determine who is trained and the extent of training, as well as economic consequences of training. Data sources were the Current Population Survey (CPS) of 1983, the National Longitudinal Surveys (NLS) of Labor Market Experience (NLS Young Men, Mature Men, and Women cohorts for 1967 to 1980); and the Employment Opportunities Pilot Projects Surveys (training of the economically disadvantaged in 1979 and 1980). It was found that nearly 40% of both men and women in the CPS reported undertaking training to improve current job skills. For a given 2-year period in the NLS, the fractions of young men, career women, and mature men reporting some training were about 30%, 24%, and 10%, respectively. For all three groups, the employer was the single most important source of training. Only 11% of the disadvantaged sample reported some training over a similar time interval, with a relatively low proportion getting training from company sources. Also assessed are analyses concerning factors that determine the probability of getting training for each source and type of training, and the effects of training on earnings, earnings growth, and employment stability. (SW)

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PREFACE

This report was funded under Contract No. J-9-M-3-0170 with the Office of the Assistant Secretary for Policy, Evaluation, and Research, U.S. Department of Labor. The study uses measures of reported training from the Current Population Survey, three cohorts from the National Longitudinal Surveys, and the Employment Opportunities Pilot Projects Survey to draw a broad picture of post-school training in the United States. The research findings on who receives training, how much, and why, and on how training affects earnings and employment, should be of interest both to employers and to decisionmakers entrusted with developing training policy.

SUMMARY

This report addresses several questions having to do with the recipients of post-school job training, the extent of such training and the reasons for it, and how it affects subsequent earnings and employment:

- How much training do the recipients get, and of what types? Do the training experiences of women, blacks, and the disadvantaged differ from those of white, male workers?
- What impels employers to offer training and individuals to receive it? Is post-school training a complement of, or substitute for, training from traditional school sources? How do local and national labor market conditions affect the likelihood of getting training?
- Is the frequency of training (or retraining) related systematically to the rate of technological change in the current job? Do skill requirements vary across high-technology and low-technology industries?
- How does training affect subsequent labor market outcomes? Which kinds of training have the largest effects on earnings and employment, and how long do these effects persist?

Our analysis is based on reported training measures from four data sources: the Current Population Survey (CPS) of 1983, and three cohorts from the National Longitudinal Surveys (NLS) of Labor Market Experience. Data on the NLS Young Men, Mature Men, and Women cohorts span the period from 1967 to 1980. We also draw on a fifth data source--the Employment Opportunities Pilot Projects (EOPP) Surveys--for information on the training experiences of the economically disadvantaged in 1979 and 1980.

The surveys contained overlapping sets of questions on the sources and types of training. By "sources" we mean where the training was obtained (from traditional schools, company training programs, informal on-the-job training (OJT), or business and technical schools). By

"type" we mean the nature or content of the training (such as managerial, professional and technical, skilled manual, and clerical). The CPS elicited information on the sources of training needed to get the current (or last) job, and on training to improve skills on the current job. In the NLS, repeated measures of both sources and types of training taken since the last interview are available.

We use several techniques to analyze the data. We document the amounts of training for each demographic group through simple tabular analysis. To study the determinants of training, we estimate probit models for each source and type of training, controlling for a comprehensive set of covariates such as personal attributes, labor market experience, job characteristics, the industry rate of technical change, and local labor market conditions. Finally, we use multiple regression and nonlinear methods to examine how training affects subsequent earnings and the likelihood of unemployment.

We found that post-school training is quite pervasive. Nearly 40 percent of both men and women in the CPS reported having taken training to improve skills on the current job, a proportion that rises with time on the job. When we average across job tenure, we find that training in company programs, OJT, and training in regular schools are reported 10 to 15 percent of the time as a source of job-relevant training. For a given two-year period in the NLS, the fractions of young men, career women, and mature men reporting some training were approximately 30, 24, and 10 percent, respectively. For all three populations, the employer was the single most important source of training. By comparison, only 11 percent of the disadvantaged (EOPP) sample reported some training over a similar time interval, with a relatively low proportion getting training from company sources. Their training experience resembled that of the sample of NLS women with low attachment to the labor force.

We reached the following conclusions regarding the determinants of training:

- Formal schooling is an important determinant of post-school investments in training. In fact, those sources of "training" are strongly complementary. The likelihood of getting most kinds of training rises with the level of schooling attainment,

with the exception of the most educated workers (postgraduates), a finding that holds true for both men and women. The lack of a formal education therefore limits access to post-school investments in most kinds of job training and to resulting improvements in productivity and income.

- Training propensity varies systematically over the life-cycle. The likelihood of getting most kinds of training is low in the first five years in the labor market, coinciding with an initial period of job search. In the absence of job attachment, this likelihood continues to fall with work experience but at a slower pace; however, the likelihood of training then rises with time on the job. Although some job switching is likely to be advantageous, the inability to develop enduring job attachment increasingly reduces the likelihood of getting training, especially for older workers.
- Nonwhite men, in particular, are significantly less likely to get most kinds of job training even after controlling for observable worker attributes. However, no significant racial differences are apparent among women. These relationships suggest that job training may be partly responsible for the observed earnings differentials among white and nonwhite men and the absence of race differences among women.
- Rapid technical change in the industry of employment increases the probability of getting managerial training and training from in-house sources such as company programs or OJT, especially for the most educated, but decreases the probability of getting professional, technical, and semiskilled manual training, or training from external sources such as business, technical, and traditional schools. Again, these findings are replicated for females. It thus appears that rapid rates of technical change are associated with an increased reliance on in-house training, possibly because skills specific to new technologies are not readily available outside the firm.
- The transferability of prior work skills diminishes when new jobs are created in industries with rapid technical change. Both men and women working in high-tech industries are

significantly less likely to report that previous company training and OJT were important in getting the current (or last) job. Only among postgraduates is previous OJT important.

- The likelihood of getting most kinds of training is smaller in local labor markets with persistently high unemployment or greater cyclic volatility relative to the nation as a whole. Over time, a pro-cyclical pattern of training emerges for the NLS samples of mature men and career women. Periods of high national unemployment tend to be associated with a greater likelihood of training from company sources, especially for professional and technical types of training. One possible interpretation is that employers are more likely to retrain older workers during periods of slack economic activity when the opportunity cost of their time is low.

To examine how training affects subsequent labor market outcomes, we used the CPS and the NLS Young Men surveys to examine the relationships between training, the level and growth of earnings, and the probability of experiencing an unemployment spell in the previous year. The principal findings are as follows:

- Earnings rise with the level of schooling completed, especially for highly educated people with college or advanced degrees in industries experiencing rapid technical change. This finding is consistent with, and may explain why, highly educated people are also more likely to get company training and informal OJT in "high-tech industries." This result provides empirical support for Welch's (1970) hypothesis regarding the allocative efficiency of schooling--namely, that better educated workers are more adept at responding to technical change.
- Among the sources of training, company training has the greatest effect on increasing earnings, an effect that persists for over 13 years. This is followed by training from business and technical schools. When types of training are considered, managerial training is the most important, followed closely by professional and technical training.

- The effects of training on unemployment mirror the earnings-augmenting effect of training. On average, vocational training is associated with a decline in the likelihood of unemployment lasting approximately 12 years. However, the effects of training on unemployment vary systematically by source and type of training.
- Unlike the result for earnings, the industry rate of technical change in the current job is not statistically correlated with the probability of experiencing an unemployment spell in the past year. In fact, for the sample of male youth studied, rapid technical change is typically associated with a lower probability of unemployment; and for high school graduates, this relationship is statistically significant. At least for this group of youth, the results suggest that concern over the labor-displacement effects of technical change may be misplaced. Whether or not this finding holds for other groups is a subject for future research.

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CONTENTS

TABLES

I. INTRODUCTION

In recent years, the federal government has become concerned about the productivity slowdown in the United States, about the effects of technological change on the labor market, about structural unemployment, and about labor market responses to changing demographic patterns. While these problems raise many kinds of policy questions, they raise especially challenging questions about training. Policies aimed at promoting worker training for the large baby-boom cohorts, for women returning to the labor force, for workers requiring skill upgrading or retraining, and for the disadvantaged, will strongly influence the productivity and wages of the U.S. work force in the years ahead.

Since 1965, labor productivity in the United States has risen sluggishly--1.7 percent per annum, as compared with 3 percent between 1950 and 1965. The emerging interest in training policies is rooted largely in the belief that greater investments in training will halt declines in labor productivity not only through enhancing the skills of new labor market entrants, or upgrading existing worker skills, but also through improving managerial and technical skills, which have a broader impact on the efficiency of production (Goldstein, 1980). Of interest also is whether such policies will be effective in offsetting declines in the international competitiveness of U.S. industries, which some have attributed to lower U.S. investments in equipment and in skill acquisition through education and training, relative to its major trading partners.[1]

Technological change, and its impact on the labor market, further motivate public and private interest in training. Over the last two decades, this interest has shifted from concern over the potential effects of automation on labor displacement and structural unemployment, which recent research suggests is misplaced (Ayres and Miller, 1983), to the changing skill requirements of new technologies. While public

[1]The President's Commission on American Competitiveness, and the Department of Labor's Bureau of International Labor Affairs, cited in Carnevale and Goldstein (1985).

attention has tended to focus on skill shortages in "high-tech" jobs (which account for less than 10 percent of the labor force), less dramatic but more pervasive skill shortages arise in the workplace as a consequence of technological change. As technologies evolve, job-specific training and retraining are constantly necessary to supply the technical and managerial skills required by new process and product innovations. By identifying these skill shortages, policies may be implemented to encourage greater investments in the skills required for technological change.

Several demographic trends--in particular, the postwar swings in birth rates and the increasing numbers of working women--also have implications for training policy. The future composition of the labor force will change both as the large baby-boom cohorts that entered the labor market in the 1970s mature and are replaced by smaller baby-bust entry cohorts, and as female labor-force participation rates rise. How well the labor market responds to these changes, and whether skill shortages materialize, will depend on the degree to which older workers, women, and youth are substitutable for each other (Tan and Ward, 1985). The outcome will be strongly affected by the amounts and kinds of training received by the different groups.

To address these issues, government officials will need comprehensive information about the amounts and kinds of training available for different demographic groups, the determinants of training, and its effects on labor market outcomes. Their information needs, however, already outstripped the available data. As Carnevale and Goldstein (1983, p. 31) have noted, "Sound theoretical literature is thin. Empirical analysis is thinner still. Those responsible for practical decisions on employee training face ignorance and confusion when they try to find reliable information."

This information gap is at least partly attributable to the perceived problems of using self-reported measures of training. In addition to the issue of reliability, reported training measures may suffer from a selective recall problem: namely, that only the most memorable (i.e., formal) kinds of training are reported, while potentially more important forms of on-the-job training are ignored. Thus, past research in the human capital tradition has tended to focus

on formal schooling, government sponsored training programs, time in the labor force, and firm tenure as proxies for training (for example, see Mincer, 1974). These proxies have been important in testing various theories, but their use has hampered understanding of the empirical correlates of training and its effects, which can only come from using actual measures of training taken.

We believe this report represents the first systematic attempt to exploit current data on reported training and answer several questions: who receives training, how much and why, and how does training affect future earnings and employment stability? Most of our data are drawn from several information-rich sources: the National Longitudinal Surveys (NLS), the Current Population Surveys (CPS), and the Employment Opportunities Pilot Projects survey (EOPP). Because detailed information is available on the kinds of training provided, we are able to pursue the analysis of training by source (in-house company programs, on-the-job training, business and technical schools, traditional schools) and by type of training (managerial, professional and technical, and semiskilled manual training).

Self-reported training measures are not wholly reliable; they clearly understate how much training actually goes on by failing to report more informal kinds of training. One survey, which contained a comprehensive set of training questions, found informal OJT to be as prevalent as training in formal company programs. This caveat notwithstanding, a remarkably consistent picture of training emerges when we compare the surveys. Patterns of training observed in the data--by source and by type, across demographic groups, and over the life cycle--are consistent both with theory and with our *a priori* expectations. Indeed, as the rest of the report demonstrates, analysis of reported training measures can yield important insights into behavior in areas where government policies may have their greatest impact through training.

Our study covers an extensive set of issues and brings together a number of different lines of research. It investigates how workers decide to take, and employers decide to give, training, the extent of various kinds of training, their sensitivity to technological change and labor market conditions, and the effects of training on subsequent

earnings level and growth, and on employment and employment stability. Many of the hypotheses investigated are guided by other developments in human capital theory; others, such as the relationships between training, technological change and local labor market conditions, represent tests of theories developed by the authors (Tan, 1980 and 1986; Lillard, 1981 and 1986).

Section II describes the five surveys we used and provides an overview of the magnitude and kinds of training obtained by different groups. Section III lays out the main hypotheses to explain the decisions to take (or give) training, followed by a summary of the most important empirical correlates of training in the five surveys. Our analysis of the effects of training on earnings, earnings growth, and employment stability are the subject of Section IV. Section V summarizes the main findings and their implications for training policy.

II. DATA SOURCES AND AN OVERVIEW OF TRAINING

We first describe the main features of the five surveys used in our analysis.[1] The surveys differ substantially in both the form and content of their training questions, and in the time period when they were conducted.

DATA SOURCES

The *Current Population Survey* (CPS) surveys a nationally representative sample of the non-institutional population several times a year. It implemented a special supplement in January 1983 to elicit information on occupational mobility, job tenure, and training. For this study, we merged one-half of the respondents in the supplement with the March 1983 demographic file to take advantage of the wealth of labor force information on weeks worked and previous year's earnings.

The *National Longitudinal Surveys* (NLS) included cohorts of Young Men, Women, and Mature Men. Panel data on the training and labor market experiences of these three cohorts are available (in versions that we use) for the period from 1966 to 1981, with four breaks in the panel. The Young Men and Mature Men samples comprised individuals aged 14-24 and 45-59 in 1966, respectively, and the Women sample those aged 30-44 in 1967.

The *Employment Opportunities Pilot Projects Surveys* (EOPP) were fielded primarily between May and September 1980. The EOPP was designed to evaluate the impact of participation and nonparticipation in a job-search/work-and-training program. The sample included both low-income and control households, but because the poverty group was oversampled relative to the nonpoor group, we will refer to the EOPP sample as the "economically disadvantaged" population.

[1] A sixth potential source is the PSID (Panel Study of Income Dynamics), a family- or household oriented-longitudinal data file covering 1968 to 1981. However, the PSID includes only crude information about whether training was taken by household heads with less than a high school degree.

Each data set has several important features that make it unique. The surveys ask different but overlapping sets of training questions, with more detail on certain kinds of training in some (informal OJT in the CPS and types of training in the NLS) than in others. The relevant reference period for training also differs both within and across surveys: fixed intervals in the NLS (ranging from one to five years), and a variable interval (years on the current job) for the CPS. These are discussed here and used throughout the report.

The CPS asked what training was needed to get the current or last job and about training to improve skills on the current job. Thus, the reference job may have begun many years ago or as recently as the past month. To mitigate potential recall errors, our analysis is restricted to people who entered their current jobs in 1959 or later. The CPS questions on training to improve skills refer to the period implied by the phrase "since you obtained your present job." In the analysis of training propensity, we will want to control for this since the individual is exposed to increased training possibilities the longer the time spent on the current job. Fortunately, the survey includes information on years of job tenure. Finally, while the questions allow only two intervals, the current job and all prior jobs, it does allow multiple responses about sources of training--a response is given for each source.[2]

The NLS asked about training taken since the last interview, a fixed period of time. However, the interval may be of varying length (one, two, or five years) depending on the elapsed time since the last interview. As such, we use subsamples based on the length of the reference period, pooling data for reference periods of the same length. Furthermore, because the person may have changed jobs during the interval, been unemployed, and so forth, we will want to control for job changes or entry and exit from the labor force, when they are known. Unlike the CPS, which allows multiple responses, the NLS training questions refer only to the "longest" training event in the interval.

[2]In the analysis of the CPS data, each source of training is treated independently, i.e., we do not estimate the joint probability of getting training from multiple sources.

Therefore, only one event in an interval is known, but there is information on multiple intervals for each person in the panel. This will be an advantage for the analysis of training effects (Sec. IV). The survey points in the three NLS cohorts and their corresponding reference periods for the training questions are shown in Table 2.1.

The EOPP survey elicited information on up to four training events occurring any time between January 1, 1979, and the interview date, which fell primarily between May and September of 1980. The training data, though detailed, are limited by the short time period considered. As in the NLS, people may have changed jobs, been unemployed, or have left the labor force in between reported training events.

The substantive content of the training questions is broadly the same across surveys, with more detail in some than in others. The surveys first ascertained whether any occupational or job-related training had been taken (termed ANY). Then the CPS, NLS, and EOPP asked about the sources of training. By source, we mean where the training was obtained, whether from regular schools, company training programs, informal OJT, business and technical schools, or from "other" sources. The NLS then also asked about types of training. By type, we mean the nature or content of training, which included managerial, professional

Table 2.1

SURVEY POINTS FOR THREE NLS COHORTS

NLS Sample	Length	Survey Years (19--)
Young Men	1-year	67 68 69 70 71 76
	2-year	73 75 78 80
Mature Men	2-year	67 69 71
	5-year	76 81
Mature Women[a]	1-year	69 72
	2-year	71
	5-year	77

[a]Training questions for 1967 and 1979 were flawed and not comparable.

and technical, clerical, semiskilled manual, or "other" types of training. Unlike the other surveys, the CPS also elicited information on the sources of training that respondents felt were important in getting the current or last job. Though clearly subjective, such information may provide insights into the job-related content of training from formal schooling (Sec. III) or the extent to which prior job skills are transferable to new jobs (Sec. IV).

Table 2.2 summarizes the information on the sources and types of training that are reported in each of the different surveys.

OVERALL PATTERNS OF TRAINING

We now turn to an overview of the general level of post-school training, the various forms it takes, and differences among the demographic groups suggested by the five surveys. We examine the training patterns of men and women in each survey separately. Recall that both the CPS and EOPP samples include persons of all ages. The NLS, on the other hand, includes separate surveys for Young Men, Women, and Mature Men aged 14-24, 30-44, and 45-59, respectively, in the first interview year (1966 or 1967). It should be kept in mind that these are more formal dimensions of training and that more informal training and learning on the job are covered less adequately. However, we will see later that these forms of training have real consequences for earnings and employment.

Traditional schooling is the most widely studied source of training. In studies that have looked at post-school training, the research focus has typically been on the effects of school curriculum on labor market outcomes, standardizing for subsequent training events (Grasso and Shea, 1979; Tannen, 1984; Meyer and Wise, 1982). To date, with the exception of the study by Carnevale and Goldstein (1985), our knowledge of post-school job training remains fragmentary.[3] To get a more comprehensive picture of training, we now turn our attention to training of any source or type, in addition to traditional schooling, that various groups receive.

[3]The Carnevale and Goldstein study uses the 1981 *Survey of Participation in Adult Education* to provide the first broad description of the size and scope of employee training in the United States.

Table 2.2

SOURCES AND TYPES OF TRAINING IN THE THREE SURVEYS

Survey	Sources and Types
	Sources of Training
NLS CPS EOPP	Company schools or courses
NLS EOPP	Business, technical and vocational schools
NLS CPS	Traditional schools, colleges and universities
CPS	Current job: informal OJT
CPS	Past jobs: informal OJT or experience needed to get current job
NLS	Other sources, such as training under Title V or the Manpower Development Act
CPS	Other sources to improve current job skills, such as Armed Forces, correspondence schools; and other sources to get job, such as friends and relatives, or other non-work-related experience
	Type of Training
NLS	Managerial
NLS	Professional and technical
NLS	Clerical--Women only
NLS	Manual, skilled and semiskilled, men only
NLS	Other types, such as nontechnical and general courses not required to obtain a certificate or degree

NOTE: CPS = Current Population Survey; NLS = National Longitudinal Surveys; EOPP = Employment Opportunities Pilot Projects Survey.

First, consider the prevalence of training necessary to get a job. More than half of all men and women in the labor force in the CPS reported that some training was necessary to get their current or last job.[4] (See Table 2.3.)

About one quarter of the CPS sample--and slightly more women than men--reported regular schooling as important, with the proportion rising dramatically with education for each.[5] This suggests that the job-related content of formal schooling rises with the level of education. Informal OJT from prior jobs is of comparable importance, but only 12 percent of men and 8 percent of women thought that previous formal

Table 2.3

PREVALENCE OF TRAINING IN THE CPS: MEN AND WOMEN

		Source of Training			
Sample	Any Training	Regular School	Company	OJT	Other
Training Prior to the Current Job Needed to Get the Current or Last Job					
Men	55.5	22.2	11.7	30.8	8.5
Women	55.0	27.9	7.5	26.0	2.7
Training to Improve Skills on the Current Job (Respondents working at the Survey)					
Men	38.0	13.6	11.6	15.1	5.4
Women	36.7	10.3	13.1	15.1	4.5

SOURCE: January 1983 CPS.

[4]Individuals could report more than one source of training, so that the sum of proportions over all sources adds to more than the proportion reporting any source. Types of training were not ascertained in the CPS survey.

[5]The fraction reporting school training as needed to get a job increases from just under 2 percent for non-high-school graduates to over 79 percent for those with graduate degrees.

company training was needed. Reporting miscellaneous other training sources were 9 percent of men and 3 percent of women. While the overall proportions were the same, women tended to cite regular school and men tended to cite company training and other forms of training.

Table 2.3 suggests that nearly 40 percent of both men and women got training to improve skills on their current job. The proportion rises steadily with tenure on the current job, since the person has been exposed to the possibility of training for a longer period. Note that the following numbers represent an average based on the tenure distribution in the CPS sample. Regular schools, company training, and OJT each are reported 10 to 15 percent of the time as a source of training to improve or upgrade job skills.[6] Clearly, the traditional school system continues to be an important source of job training for workers who have completed their formal schooling. Only about 5 percent reported training from other sources.

Now consider the prevalence of training in fixed-length intervals in the three NLS cohorts. Training information is reported for the longest training event in the interval, the length of the reference period being determined by the survey questions relating to time "since the last survey." These values are reported in Table 2.4 for young and mature men and in Table 2.5 for women with varying degrees of attachment to the labor force.

The proportions reporting any training in the NLS surveys differ among groups substantially more than in the CPS. In part, this may be attributed to age differences across the three NLS cohorts, and changes in training patterns over the life-cycle are likely to be important. Because each NLS group includes a 2 year interval, these are most directly comparable. Young men and career women (who always worked throughout the 12-year panel) have the greatest proportions receiving any training--30 percent and 24 percent, respectively--which is more than twice that of mature men (10 percent). However, a closer examination reveals differences in the kinds of training received by the

[6] 16.5 percent of men and 14.9 percent of women reported multiple sources of training to improve skills. Company training and OJT were the multiple sources most frequently reported jointly.

Table 2.4

PREVALENCE OF TRAINING AMONG NLS MEN
(In percent)

Sample and Time Interval	Any Training	Source of Training				Type of Training			
		Company	Business and Technical School	Regular School	Other	Profes-sional	Manage-rial	Skilled and Semi-Skilled	Other
Young Men									
1 year	24.3	7.6	3.7	3.6	9.4	8.6	2.7	8.2	4.8
2 year	29.7	10.4	5.2	5.2	9.0	11.4	4.0	6.8	7.5
Mature Men									
2 year	10.2	3.3	.4	--	6.4	4.2	2.0	1.7	2.2
5 year	17.2	5.6	1.0	--	10.6	8.9	2.7	2.3	3.4

Table 2.5

PREVALENCE OF TRAINING AMONG NLS WOMEN
(In percent)

Time Interval	Any Training	Source of Training			Type of Training			
		Company	Business and Tech School	Other	Profes-sional	Manage-rial	Clerical	Other
Always Work								
1 year	22.9	3.6	1.1	18.1	10.1	1.6	3.0	6.9
2 year	23.7	3.2	1.3	19.2	9.4	1.5	3.2	8.2
5 year	36.1	7.6	2.9	25.6	19.8	3.8	4.9	5.7
Works Intermittently--Working at Survey								
1 year	16.3	3.0	.8	12.6	6.0	.4	2.1	6.3
2 year	20.1	1.6	.6	17.9	5.2	.4	2.7	9.2
5 year	31.1	4.0	3.6	23.4	14.1	2.2	5.3	6.9
Works Intermittently--Not Working at Survey								
1 year	12.4	.8	.4	11.2	3.2	2.0	1.7	6.0
2 year	9.4	.5	.1	8.8	2.4	.0	1.8	3.8
5 year	18.0	2.4	1.5	14.2	6.4	.2	3.2	6.0
Never Worked								
1 year	5.6	.1	.2	5.3	.5	.1	.6	3.8
2 year	5.0	.0	.5	4.5	1.2	.0	.3	3.2
5 year	10.7	.5	1.0	9.2	2.3	.2	1.6	5.7

different groups. In particular, compared with both young and mature men, a smaller fraction of career women reported getting company or managerial training, and the prevalent source of training was from unspecified "other" sources.[7]

In general, the proportion reporting any training increases with the length of the interval, but not even close to proportionately. Moving from a 1-year to a 2-year interval, young men reported a greater increase than women; and moving from a 2-year to a 5-year interval, mature men report a greater increase (proportionately) than mature women.

Briefly consider women who are less attached to the labor force than career women. Those women who did not work at any time (except possibly once) through the panel years reported very little training. The training they did report tended to be of the miscellaneous "other" source or type. Some women work intermittently, entering and exiting the labor force frequently. These women had training patterns much like those of career women in the periods in which they worked, and reported patterns somewhat like those of women who never worked in the periods in which they (the same women) did not.

Turning to the disadvantaged (EOPP) sample, only about 11 percent of men and women reported getting training from any source. (See Table 2.6.) These proportions pertain to a reference period of approximately 17 to 21 months, and are therefore most comparable to the NLS 2-year intervals. While the proportion getting business and technical school training is roughly comparable to those in the other groups, only a small percentage report OJT. In fact, their training experience most closely resembles that of the sample of NLS women with low attachment to the labor force.

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[7]Cross-tabulations of training by source and by type (not reported here) are informative about the sources of various types of training in the NLS. Nearly half of managerial training is provided by company sources, the proportion being a bit lower for women. The remainder comes from ambiguous "other" sources, with relatively little coming from business, technical, and vocational schools. Surprisingly little professional training comes from business, technical and vocational schools. A much larger share comes from company schools, but most comes from other sources.

Table 2.6

PREVALENCE OF TRAINING AMONG DISADVANTAGED WORKERS

Sample	Any Training	Source: Business and Technical School	Source: OJT	Source: Other
Men	10.9	4.0	2.6	4.6
Women	12.0	4.4	2.3	5.7

SOURCE: EOPP.
NOTE: Interval length is between 17 and 21 months.

Let us return to the issue of the training taken over successively longer intervals of time. We have provided some insights from the NLS Young Men sample. Table 2.7 shows the probability of engaging in training other than from regular schools, over intervals several periods (years) long.[8] The period begins with the first observed period of work--either upon completion of full-time schooling (upper panel of the table) or the first period observed already working (lower panel). Reading across columns, the first row reports the proportion receiving no training. In the upper panel, this figure declines from over 86 percent in the first year of work to 33 percent after nine periods (survey years). Reading down the rows, after (say) 5 periods, the table suggests that about 54 percent receive training in at least one period; over 28 percent report at least two training episodes. These training patterns are mirrored for the sample in the lower panel.

[8]Each individual enters the calculation several times, until he either drops out of the sample or reaches the maximum length of his longest interval of continuous participation in the panel. Note that the NLS youth in the upper and lower panels are mutually exclusive and exhaustive samples.

Table 2.7

MULTIPLE TRAINING EVENTS IN THE NLS: YOUNG MEN

Number of Periods in which Received Training	Number of Potential Periods of Work								
	1	2	3	4	5	6	7	8	9
	From First Period of Full-Time Work								
None	86.2	72.5	59.7	51.6	45.9	44.0	38.5	35.2	33.0
1	13.8	21.8	25.5	26.1	25.6	23.5	26.4	18.8	17.6
2		5.7	11.2	13.5	15.1	16.2	15.4	23.2	18.5
3			3.6	7.2	8.5	9.3	9.1	8.9	12.9
4				1.6	4.3	4.3	6.1	8.3	9.9
5					0.6	5.5	3.1	2.9	5.2
6						0.3	1.2	1.6	2.6
7							0.2	1.0	0.4
8								0.3	
Sample size	1870	1540	1298	1078	867	680	519	384	233
	From First Period Observed, Already Working								
None	90.0	78.0	67.7	59.4	53.9	46.5	41.8	37.2	32.6
1	10.0	17.4	22.3	23.2	23.2	24.8	24.8	25.0	22.8
2		4.7	7.5	11.2	12.0	12.9	13.0	14.2	15.7
3			2.6	4.9	7.0	7.9	9.2	9.4	10.3
4				1.3	3.4	5.6	6.3	6.5	8.1
5					0.6	2.1	3.6	4.2	4.2
6						0.2	1.3	2.8	4.0
7								0.7	1.6
8								0.1	0.6
9									0.1
Sample size	2719	2343	2036	1874	1751	1598	1486	1343	1210

SOURCE: NLS Young Men.

What do these patterns look like when the data are disaggregated by source and type of training? Several patterns of training over time are revealed in Table 2.8. If we exclude miscellaneous sources, company training programs are the largest source of training. The upper panel indicates that the cumulative probability of receiving any company

training rises steadily, to over 27 percent by the ninth year in the labor market. Over the same interval, about 20 percent get training in business and technical schools, but most of the increase is concentrated in the first five years. Perhaps because these are skills useful to many firms, employers have few incentives to provide general training and individuals must get (and pay for) this training themselves prior to joining the firm or early in their careers (Becker, 1975).

The cumulative probabilities of getting different types of occupational training are displayed in the lower panel of Table 2.8. Professional and technical training is by far the commonest form of

Table 2.8

TRAINING OVER EXTENDED PERIODS OF TIME: PERCENT RECEIVING TRAINING OVER GIVEN INTERVALS, BY SOURCE AND TYPE OF TRAINING

Sources and Types	Number of Potential Periods of Work								
	1	2	3	4	5	6	7	8	9
Source of training									
Company	3.1	8.2	15.0	20.2	24.2	27.5	29.5	34.9	36.9
Business or technical	1.7	7.2	10.8	13.1	15.1	15.9	17.7	18.5	19.7
Miscellaneous other	5.3	3.5	21.3	26.9	31.5	32.2	36.1	39.9	44.0
Type of training									
Managerial	.5	3.2	5.9	7.3	9.0	10.0	11.2	16.4	19.7
Professional technical	2.2	17.8	27.3	32.6	38.8	38.8	40.8	43.7	46.8
Semiskilled manual	5.4	7.9	11.4	15.0	19.1	21.0	23.5	25.3	26.2
Miscellaneous other	3.2	7.8	13.4	16.8	19.0	22.4	25.6	27.3	32.3

SOURCE: NLS Young Men.

training reported, and managerial training the least common. Professional and technical training tends to be concentrated early in the career. The probability of managerial training is low initially, but rises over time, as might be expected if long promotion times are required to attain managerial rank.

SUMMARY

The surveys provide a wealth of detail on the training experiences of different demographic groups. While there are important differences in the nature and form of the training questions asked, they overlap and permit comparisons of the magnitude and sources of training across surveys. Taken together, these surveys provide a much broader perspective on the dimensions of training than is available with any one data source.

This brief overview revealed several important stylized facts about the magnitude and composition of post-school training received by the different demographic groups.

First, almost 40 percent of men and women report having taken some training to improve existing skills while on the current job.

Second, over a fixed time interval, young men and career women received more training than mature men, which is consistent with a life-cycle pattern of training predicted by human capital theory. However, a smaller fraction of career women receive company or managerial training than of either cohort of young or mature men.

Third, women with intermittent labor market experience receive little training, and when they do, much of it is from miscellaneous "other" sources.

Finally, the economically disadvantaged group is characterized by a low likelihood of training, much like the sample of women with weak attachment to the labor force.

III. THE DETERMINANTS OF TRAINING

Several patterns of training emerged from the overview in Sec. II. First, career women in the NLS appear to receive relatively less company and managerial training and more of other kinds of training than do young or mature men. These differences are not apparent in the CPS samples, at least for training sources. Second, relative to other groups, a smaller proportion of the disadvantaged (EOPP) group report getting any training, and those that do receive relatively less company training. Finally, as much as a third of the young men in the NLS get no training, even after nine survey periods, while many report getting multiple training events.

To determine the reasons for those differences, this section explores the factors that determine the probability of getting training in a fixed interval (NLS and EOPP surveys) or over a variable reference period (time on the current job in the CPS). For each sample, we estimate separate probit models for each source and type of training.[1] As suggested in Sec. II, economic forces are likely to affect individual or employer decisions to take or provide the various kinds of training.

Each probit model includes a common set of regressors on schooling, race, labor force experience, the industry rate of technical change, and local and national labor market conditions. Schooling effects are captured by separate variables for each of five levels of educational attainment: less than 12, 12, 13-15, 16, and more than 17 years of school. Ethnic origin is controlled for using an indicator variable, NONWHITE, with a value of 1 if nonwhite, 0 otherwise. Two measures of labor market experience are included: years on the current job and years of potential labor market experience, the latter being computed as age minus years of schooling minus 5.[2]

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[1]Thus, as noted earlier, we do not estimate the joint probability of training from multiple sources (CPS), or of multiple training episodes over time (NLS).

[2]As is widely known, this potential experience measure is an especially poor measure of actual work experience for women who exit and enter the labor force more frequently than do males. For the NLS Young Men sample, only years of potential work experience is included. Close

Technical change plays a central role in our analysis. The perspectives on technical change, and its relationship to training requirements, come from research by Tan (1980, 1986). The argument is that many job-relevant skills are technology-specific, and are acquired through working with particular production technologies and specialized equipment. As technological change advances, technology-specific skill requirements also grow apace. To the extent that few of these skills are readily available outside the firm, we might expect the demand for in-house company training to increase with the industry rate of technical change. Second, it has been argued that workers with more education are more adept at critically evaluating new information, and therefore respond to technical change more readily (Welch, 1970). This "allocative efficiency" of schooling hypothesis suggests that innovative firms in high-technology industries are more likely to use highly educated and technically skilled workers.

To test these hypotheses, we use the measures of technical change developed by Gollop and Jorgenson (1980) for the most recent period available at the time of this study, 1966-1973. The measures are derived from CRS (constant returns to scale) translog production functions, which include as inputs both quality-adjusted indices of capital and labor and intermediate products. They are available for 45 two- and three-digit industrial groupings. Using these indices of technical change, jobs may be characterized as being more or less "technologically progressive." We interact the technical change measures with schooling attainment. This allows us to investigate the (potentially different) relationships between technical change and the likelihood of getting training for more and less educated workers.

The role of local labor market conditions is considered in a limited way. Ideally, we would consider the separate effects of both cross-sectional and local time series labor market conditions as in Lillard (1981, 1986). However, data limitations restrict what can be done. While the CPS identifies the state in which an individual lives,

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examination of the imputed job-tenure variable (respondents were not asked job tenure directly in many years) revealed the measure to be quite deficient.

the training questions are for a variable length of time determined by the person's current job tenure. Therefore, we use only the state indices of labor market conditions developed in the Lillard study. These are the cyclic sensitivity of the state to national unemployment cycles (denoted RHAT) and the state's relative long-run unemployment level (denoted SHAT). While the NLS training variables are for a well-defined period of time, the state of residence of the individual is not available. Therefore, we use the national unemployment rate as an aggregate measure of labor market conditions.

Other demographic control variables include region of residence, and, for young men and women in the NLS, measures of job change or labor force attachment when available. For the CPS the regions include South, North East, North Central, and West (the omitted category). For the NLS the regions are simply South and Non-South (the omitted category) because that is all the locational information available.

We begin with an exploration of the determinants of training from regular school sources. As shown in Sec. II, a sizeable fraction of persons continue to get training from traditional schools even after entering the labor force. This is followed by an analysis of training from sources other than regular schools: company training programs, informal OJT (CPS), business and technical schools, and other sources. For the NLS surveys, probit estimates for types of training--managerial, professional and technical, semiskilled manual, and other types--are also reported. We then briefly examine the training experiences of the disadvantaged EOPP sample, before concluding with a summary of the main findings.

REGULAR SCHOOLS AS A TRAINING SOURCE AFTER BEGINNING WORK

Here we consider regular school training obtained after beginning work for young men in the NLS, and to improve job skills on the current job for men and women in the CPS.[3]

[3]In the other NLS surveys of women and mature men, and in the EOPP survey, no information was elicited on training from regular school sources.

Individuals may get training from regular schools for different reasons: to complete interrupted full-time schooling, to acquire additional job-related skills, or both.[4] The CPS does not distinguish between these motives. For the NLS, we exploit the panel nature of the survey to create two control variables, SCHWRK and SCHWRKT. The first is an indicator variable, with a value of 1 if the individual attains a higher level of schooling over the panel after beginning full-time work, 0 otherwise. Conditional on SCHWRK, the second variable indicates whether the reference period falls within the interval in which the person is completing school. In this schema, those who get regular school training but do not increase their level of schooling (SCHWRK = 0) are interpreted as getting training to improve job skills.[5]

Before turning to the analysis, some broad figures on the extent of regular school training are useful. First, 3.6 percent of young men reported regular schooling as a training source in a 1-year period, and 5.2 percent in a 2-year period. However, remember that these training events are for the "longest" event in the interval and may not be associated with the same employer. Second, consider regular school training to improve job skills in the CPS. Since obtaining their current jobs, 3.4 percent of both men and women reported taking training from this source. However, since the CPS training question implies a cumulative period of exposure, the probability of training (of any kind) should increase with job tenure, and it does.

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[4]Standard models of human capital investment predict that full-time schooling should occur as early as possible in the life cycle. However, as a practical matter, students must sometimes interrupt full-time schooling or finish school on a part-time basis. This is especially true of college or graduate schooling. For those young men in the NLS who completed college during the panel period 1967-1980, 35 percent found it necessary to interrupt their schooling with a period of "work as primary activity" before finishing college. For those who experienced a gap, approximately 80 percent finished college in 4 years or less, and only 2.5 percent took more than 6 years. Of college graduates, approximately 44 per cent completed some graduate schooling. Only 20 percent of this group managed to complete their formal education without interruption before starting work as their main activity.

[5]This would include those taking one or two courses without credit in a regular school as well as those failing to complete course work for a higher degree.

Tables 3.1 and 3.2 report the relationship of training from regular school sources to covariates for the CPS and NLS samples, respectively. The results are quite similar for men and women in the CPS, and between them and the young men in the NLS.

The probability of receiving regular school training increases with the level of schooling attainment, with a much higher likelihood of training for those with postgraduate degrees. These relationships are not only highly significant statistically in the CPS, but also are very similar for both men and women. Highly educated women, however, are more likely than men to obtain additional training from this source. Broadly similar results are also found in both the 1-year and 2-year NLS samples. For NLS young men, completion of interrupted schooling appears to be an important motive for training, as suggested by the positive and significant coefficient on the SCHWRK variable. This group, however, is also more likely to get other forms of training (see Appendix), which may indicate that SCHWRK is also picking up the effects of unobserved ability or motivation.

Interestingly, the probability of regular school training is diminished in industries associated with high rates of technological change. Again, this relationship is statistically significant in the CPS samples, especially for women. In the NLS, this relationship is especially pronounced at the postgraduate level. Taken at face value, this result might be interpreted as a repudiation of the "allocative efficiency" of schooling hypothesis. However, two points should be noted. First, regular schools are only one source of training; other sources exist, both within the firm and outside. Second, and more important, the hypothesized skill requirements are for more job-specific skills in rapidly changing industries, a demand not likely to be met from regular school sources. And it is not, as suggested by this result. Indeed, this is part of an overall pattern of the effects of technical change on training requirements to be discussed later.

Other job characteristics appear to affect the likelihood of training, but for reasons that are unclear. For example, union jobs are associated with more regular school training (statistically significant for the CPS samples), while the self-employed group reported less of

Table 3.1

REGULAR SCHOOLS TO IMPROVE CURRENT JOB SKILLS: CPS MEN AND WOMEN

Variable	Men	Women
Constant	-1.814 *** (0.082)	-1.603 *** (0.083)
Schooling <12 years	-0.514 *** (0.075)	-0.457 *** (0.090)
Schooling 13-15 years	0.464 *** (0.043)	0.543 *** (0.042)
Schooling 16 years	0.618 *** (0.047)	0.670 *** (0.052)
Schooling 17+ years	1.044 *** (0.045)	1.288 *** (0.058)
Technical change interaction		
Schooling <12 years	-4.135 (6.029)	-41.748 *** (10.009)
Schooling 12 years	-9.999 *** (2.912)	-28.146 *** (3.329)
Schooling 13-15 years	-11.506 *** (3.128)	-15.350 *** (3.427)
Schooling 16 years	-11.356 *** (3.151)	-21.970 *** (5.615)
Schooling 17+ years	-14.588 *** (3.766)	-37.254 *** (7.932)
Nonwhite	-0.192 *** (0.061)	-0.200 *** (0.054)
South region	-0.107 ** (0.045)	-0.082 * (0.047)
North East region	-0.190 *** (0.054)	-0.199 *** (0.057)
North Central region	-0.014 (0.045)	-0.033 (0.049)
Union member	0.151 ** (0.059)	0.344 *** (0.067)
Union missing	-0.008 (0.035)	0.029 (0.036)
First 5 years of work	0.100 ** (0.045)	-0.100 * (0.051)
Potential work experience	-0.002 (0.002)	-0.006 ** (0.002)
Years of job tenure	0.034 *** (0.003)	0.046 *** (0.003)
Self-employed	-0.170 *** (0.053)	-0.077 (0.069)
SHAT (long-run state unemployment rate)	-1.104 (2.882)	2.033 (2.829)
RHAT (cyclical sensitivity of state unemployment)	0.089 * (0.047)	-0.003 (0.050)

SOURCE: January 1983 CPS.
NOTE: Probit specification, standard errors in parentheses.
* Significant, from zero, at 10 percent level.
** Significant, from zero, at 5 percent level.
*** Significant, from zero, at 1 percent level.

Table 3.2

TRAINING FROM REGULAR SCHOOL SOURCES--NLS YOUNG MEN

Variable	Interval length	
	1-Year	2-Year
Constant	-2.236 ***	-1.904 ***
	(0.111)	(0.134)
Schooling <12 years	-0.146 **	-0.371 ***
	(0.075)	(0.094)
Schooling 13-15 years	0.298 ***	0.189 ***
	(0.061)	(0.063)
Schooling 16 years	0.308 ***	0.374 ***
	(0.081)	(0.069)
Schooling 17+ years	0.704 ***	0.567 ***
	(0.070)	(0.066)
Technical change interaction		
Schooling <12 years	1.675	-0.547
	(5.703)	(5.925)
Schooling 12 years	-8.712 **	-3.683
	(3.490)	(3.340)
Schooling 13-15 years	-5.186	-4.057
	(3.426)	(3.674)
Schooling 16 years	-3.107	-4.520
	(7.266)	(4.706)
Schooling 17+ years	-17.455 ***	-12.277 ***
	(5.869)	(4.417)
Nonwhite	-0.138 **	-0.046
	(0.056)	(0.056)
South region	-0.101 **	-0.107 **
	(0.047)	(0.045)
Union member	0.041	0.007
	(0.071)	(0.075)
Union missing	-0.144 **	-0.077
	(0.068)	(0.068)
First 5 years of work	0.181 ***	0.039
	(0.066)	(0.067)
Potential work experience	0.005	-0.008
	(0.008)	(0.006)
Changed job in interval	-0.049	-0.059
	(0.050)	(0.048)
Job change missing	-0.036	0.128 **
	(0.063)	(0.060)
SCHWK (school completion)	0.200 ***	0.150 ***
	(0.054)	(0.050)
SCHWKT (period in school completion interval)	-0.036	0.159 **
	(0.062)	(0.066)
NUR (national unemployment rate)	0.042 **	0.021
	(0.016)	(0.013)

SOURCE: NLS Young Men.
NOTE: Probit specification, standard errors in parentheses.
* Significant, from zero, at 10 percent level.
** Significant, from zero, at 5 percent level.
*** Significant, from zero, at 1 percent level.

this source of training. For the latter, one might speculate that to the extent that employers use formal schooling as a screening device, the self-employed would have few incentives to invest in such credentials.

Consistent with the prediction of standard human capital models, most training from regular schools is concentrated early in the work career. Workers who were in their first five years in the labor force when they first got the current job (CPS), or who are currently in the first five years (NLS), are more likely to report regular school training. This probability declines with potential work experience, namely, as these times occur later in the work career. As time in the current job increases, the probability rises but that is to be expected since the person is exposed to training possibilities for a longer period of time. In the NLS, the coefficient of potential work experience is positive but not significant, possibly reflecting the net (and opposite) effects of labor market experience and unmeasured job tenure.

Three other determinants of regular school training are noteworthy. First, nonwhite workers (NONWHITE) are significantly less likely to get training, by about 20 percent for both men and women in the CPS, and by a smaller amount among youth in the NLS. As we shall see, this race effect persists as well for other sources and types of training. Second, important regional variations in training are found: lower in the South, and greatest in the West. Finally, NLS young men are more likely to report getting school training in years of high national unemployment rates (NUR). One possible interpretation is that the incentives for training (or retraining) are greater when the opportunity cost of time is low, i.e., in times of slack economic activity. No significant effects of local labor market conditions (SHAT and RHAT) on training are found for the CPS samples.

TRAINING FROM SOURCES OTHER THAN REGULAR SCHOOL

Training from sources other than regular schools include training from company programs, informal OJT (reported in the CPS), business and technical schools, and other sources. In the NLS, we also distinguish between sources and types of training, the latter including managerial, professional and technical, semiskilled manual, and other training types.

As noted in Sec. II, the bulk of training reported after beginning work comes from these sources. Beneath these aggregate figures, however, important differences in the composition of training are found across the various demographic groups, and across surveys. For example, NLS young men are more likely than career women to get company training, and the disadvantaged EOPP sample report informal OJT less frequently than other groups in the CPS. Our objective here is to gain insights into the causes for these differences, focusing in particular on the role of schooling, technical change, race, and local and national economic conditions. The effects of other control variables are broadly similar to those reported earlier for regular school sources, and are not elaborated on here.

As before, we estimate probit models of the likelihood of getting training from each source, and, for the NLS, an additional set of estimates for training by type. In addition, we distinguish between the CPS questions on training needed to get the current job and training to improve job skills. For each population, a comprehensive set of regressors are included to control for worker characteristics, the industry rate of technical change, and local labor market or national economic conditions. In the discussion that follows, we summarize the effects of the most important regressors on the likelihood of getting training. The probit estimates on which these figures are based are reported in full in the Appendix.

Schooling

The effects of schooling on training probability are reported in Tables 3.3 and 3.4 for the CPS and NLS samples, respectively.

As before, formal schooling emerges as an important determinant of most post-school investments in training. In fact, both sources of "training" are strongly complementary. Compared with high school graduates (the omitted group), the probability of getting most kinds of training rises with education to a peak at 16 years or less of schooling. The only exception, training from "other" sources, rises steadily with schooling much like the earlier result for regular school training. These results are qualitatively quite similar for men and women in the CPS (Table 3.3), and between them and the three NLS populations (Table 3.4). One implication of this complementarity is that people with limited formal schooling also face limited training opportunities in the workplace, and lower future productivity and income growth.

Table 3.3

EFFECTS OF EDUCATIONAL ATTAINMENT ON THE PROBABILITY OF TRAINING, BY SOURCE: CPS MEN AND WOMEN

	CPS MEN			CPS WOMEN		
Educational Attainment	Company Training	Informal OJT	Other Sources	Company Training	Informal OJT	Other Sources
Schooling <12 years	-0.483 *** (0.059)	-0.076 * (0.046)	-0.392 *** (0.090)	-0.414 *** (0.076)	-0.095 * (0.055)	-0.568 *** (0.129)
Schooling 13-15 years	0.229 *** (0.040)	0.102 *** (0.038)	0.317 *** (0.059)	0.242 *** (0.041)	0.081 ** (0.037)	0.103 * (0.056)
Schooling 16 years	0.478 *** (0.043)	0.116 *** (0.043)	0.552 *** (0.062)	0.373 *** (0.051)	0.099 ** (0.047)	0.410 *** (0.063)
Schooling 17+ years	0.308 *** (0.045)	-0.051 (0.046)	0.832 *** (0.057)	0.301 *** (0.061)	-0.116 * (0.062)	0.265 *** (0.098)

NOTES: In the CPS, training refers to training to improve skills in current firm of employment. The omitted group are high school graduates with 12 years of schooling. Standard errors of probit estimates in parentheses.
* Significant, from zero, at 10 percent level.
** Significant, from zero, at 5 percent level.
*** Significant, from zero, at 1 percent level.

Table 3.4

EFFECTS OF EDUCATIONAL ATTAINMENT ON THE PROBABILITY OF TRAINING, BY SOURCE: NLS YOUNG MEN, MATURE MEN, AND CAREER WOMEN

	Young Men			Mature Men			Career Women		
Educational Attainment	Company Training	Business and Technical Schools	Other Sources	Company Training	Business and Technical Schools	Other Sources	Company Training	Business and Technical Schools	Other Sources
Schooling <12 years	-0.437 *** (0.068)	-0.522 *** (0.084)	-0.385 *** (0.068)	-0.331 *** (0.070)	-0.154 (0.172)	-0.285 *** (0.056)	-0.232 (0.179)	0.418 (0.378)	-0.270 ** (0.106)
Schooling 13-15 years	0.301 *** (0.046)	0.047 (0.054)	0.186 *** (0.047)	0.190 ** (0.079)	0.177 (0.191)	0.279 *** (0.069)	0.236 * (0.135)	0.248 (0.369)	0.376 *** (0.091)
Schooling 16 years	0.454 *** (0.054)	-0.229 *** (0.072)	0.203 *** (0.057)	0.106 (0.113)	0.547 *** (0.191)	0.401 *** (0.087)	0.058 (0.209)	0.312 (0.622)	0.893 *** (0.140)
Schooling 17+ years	0.261 *** (0.054)	-0.066 (0.062)	0.360 *** (0.052)	-0.076 (0.108)	0.047 (0.285)	0.625 *** (0.079)	-0.067 (0.245)	-0.224 (7.612)	1.105 *** (0.265)

NOTES: Probit estimates for 2-year intervals in the case of young and mature men, and for 1-year intervals for career women. Standard errors are enclosed in parentheses. The omitted group are high school graduates with 12 years of schooling.

* Significant, from zero, at 10 percent level.
** Significant, from zero, at 5 percent level.
*** Significant, from zero, at 1 percent level.

Increases in the level of schooling also have quantitatively different effects on training likelihood, varying by source of training and across various subgroups. We discuss each of these in turn.

First, compared with men, higher schooling among CPS women is associated with smaller increases in the probability of training from any source except, as noted earlier, additional training from regular school sources. For example, relative to high school graduates (the omitted group), female college graduates are only .37 percent more likely to get company training as compared with .48 percent for their male counterparts. Unlike their male counterparts, women graduates report training from "other" sources as the only statistically important source across education groups, the one exception being a greater likelihood of company training for college graduates.

A comparison of NLS young and mature men also points to important life-cycle training patterns among various educational groups, especially with regard to company training. The likelihood of company training is significantly higher for more educated young men in the NLS, differences not apparent among NLS mature men. This training pattern is consistent with, and may explain, observed wage profile differences among schooling groups reported in the literature in which the more educated experience higher rates of wage growth (Mincer 1974).

Finally, mature college graduates in the NLS get more training from business and technical schools than do their younger counterparts. Plausibly, this may reflect a greater demand among older workers for retraining and skill-upgrading.

Technological Change

How does technological change affect skill requirements? Earlier, it was noted that the likelihood of regular school training was lower in jobs characterized by rapid technological change, especially for the most educated. We pursue this line of questioning for each source and type of training, using the same specification of technological change interacted with level of schooling attainment. In addition, using the CPS we examine the issue of how transferable prior job skills are across jobs, and whether this relationship (if any) is affected by the rate of technological change in the current job.

Tables 3.5, 3.6, and 3.7 summarize the effects of technological change for the CPS and NLS samples. Table 3.5 reports the results for the CPS of two kinds of training questions: training needed for or important to getting the current job, and training to improve current job skills. Tables 3.6 and 3.7 include both source and type of training for the three NLS groups.

A strikingly similar pattern of technological change effects on skill requirements is found in all five samples of men and women in the CPS and NLS. First, note that company training to improve skills is significantly more prevalent for the most highly educated in high-tech industries: postgraduates among CPS males (Panel A of Table 3.5) and NLS mature men (Panel B, Table 3.6), and NLS youth with 16 or more years of schooling (Panel A). We adopt the term "high-tech" for brevity even though it is not strictly correct. With variations, the result holds as well for female workers. In high-tech industries, CPS women with 17 or more years of schooling are more likely to get company training, while those with a high school education or less are significantly less likely to do so (Panel B, Table 3.5). This pattern of company training is repeated among NLS career women (Table 3.7).

Surprisingly, less formal kinds of company training in the CPS are not related to the rate of technical change. Only male high school graduates are significantly more likely to get informal OJT in high-tech industries; no systematic pattern of informal OJT is found for other schooling groups or for women. It appears that informal OJT is poorly recalled and reported, except perhaps when the respondent perceives it to be important (see below).

In contrast, training (taken to improve skills, in the CPS) from sources other than the employer is less prevalent in high-tech industries. In the CPS samples, four out of five technical-change/schooling interactions for training from "other" sources are negative, several significantly so. Similarly, in the NLS the likelihood of training from business and technical schools or "other" sources is generally diminished in high-tech industries, with the more educated being less likely to get such training.

Table 3.5

EFFECTS OF TECHNOLOGICAL CHANGE ON THE PROBABILITY OF TRAINING, BY SOURCE: MEN AND WOMEN IN THE CPS

Educational Attainment	Training Needed to Get Current Job: Company Training	Training Needed to Get Current Job: Informal OJT	Training Needed to Get Current Job: Other Sources	Training to Improve Job Skills: Company Training	Training to Improve Job Skills: Informal OJT	Training to Improve Job Skills: Other Sources
A. CPS Men						
Schooling <12 years	-5.106 (4.469)	-4.213 (2.695)	-9.854 *** (3.798)	1.925 (4.539)	-1.200 (3.131)	2.822 (7.712)
Schooling 12 years	-4.980 ** (1.955)	-7.058 *** (1.725)	-3.202 (2.347)	0.408 (2.323)	5.525 *** (2.124)	-9.097 ** (3.800)
Schooling 13-15 years	-5.512 ** (2.738)	-2.596 (2.337)	-7.850 ** (3.124)	2.878 (2.736)	-0.809 (2.823)	-0.306 (4.151)
Schooling 16 years	-6.472 ** (2.981)	0.520 (2.874)	3.005 (4.067)	3.561 (2.984)	-0.561 (3.358)	-3.261 (4.311)
Schooling 17+ years	-0.311 (4.894)	14.338 *** (3.632)	-2.083 (5.734)	15.322 *** (3.951)	6.632 (4.487)	-8.307 (5.411)
B. CPS Women						
Schooling <12 years	-24.843 *** (6.595)	6.782 * (3.853)	-3.786 (8.168)	-23.692 *** (8.936)	2.337 (4.620)	-46.897 ** (20.172)
Schooling 12 years	-16.008 *** (3.140)	-3.469 * (2.055)	-4.424 (4.149)	-14.787 *** (2.824)	-2.191 (2.487)	-23.260 *** (4.239)
Schooling 13-15 years	-9.553 ** (3.875)	-5.639 * (3.132)	-0.331 (5.649)	-5.505 (3.628)	-2.988 (3.636)	-13.579 *** (4.838)
Schooling 16 years	6.569 (5.558)	6.514 (4.920)	7.717 (8.901)	0.091 (4.900)	2.282 (5.283)	4.687 (6.625)
Schooling 17+ years	-4.699 (10.039)	25.745 ** * (7.046)	13.223 (11.348)	18.435 ** (8.170)	7.627 (9.927)	-27.000 (18.085)

NOTE: Standard errors of probit estimates in parentheses.
* Significant, from zero, at 10 percent level.
** Significant, from zero, at 5 percent level.
*** Significant, from zero, at 1 percent level.

Table 3.6

EFFECTS OF TECHNOLOGICAL CHANGE ON THE PROBABILITY OF TRAINING, BY SOURCE AND TYPE: MALES IN THE NLS

Educational Attainment	Source of Training			Type of Training		
	Company Training	Business and Technical Schools	Other Sources	Managerial	Professional and Technical	Skilled and Semiskilled
A. NLS Young Men						
Schooling <12 years	4.250 (4.621)	18.005 *** (5.364)	7.035 (5.431)	9.938 (10.018)	9.914 (7.361)	15.638 *** (4.486)
Schooling 12 years	1.250 (2.465)	-4.796 * (2.715)	-5.062 * (2.620)	-1.498 (4.524)	-2.545 (2.699)	-4.675 ** (2.221)
Schooling 13-15 years	0.283 (2.583)	-3.219 (3.124)	-7.542 ** (2.956)	5.064 (3.709)	-3.153 (2.746)	-9.867 *** (2.909)
Schooling 16 years	9.866 *** (3.351)	-6.554 (4.820)	-8.612 * (4.624)	10.435 ** (4.931)	-6.851 ** (3.353)	4.132 (4.850)
Schooling 17+ years	16.877 *** (3.462)	0.302 (4.550)	-13.354 *** (4.305)	20.738 *** (4.235)	-10.974 *** (3.428)	-0.018 (6.630)
B. NLS Mature Men						
Schooling <12 years	0.767 (3.720)	6.104 (11.073)	-0.554 (2.941)	6.618 (4.901)	-6.983 (5.385)	n.a.
Schooling 12 years	-5.976 (4.752)	8.708 (9.873)	-3.273 (4.136)	-1.184 (5.989)	-11.809 ** (4.931)	n.a.
Schooling 13-15 years	-1.232 (4.967)	-6.039 (11.804)	-17.600 *** (5.263)	-3.662 (8.691)	-11.630 ** (4.544)	n.a.
Schooling 16 years	-4.346 (8.660)	-17.591 (24.302)	-15.266 ** (7.075)	-3.528 (11.015)	-16.202 ** (6.962)	n.a.
Schooling 17+ years	32.111 *** (7.226)	-16.564 (25.753)	-5.786 (6.792)	34.462 *** (8.138)	-11.501 (7.520)	n.a.

NOTES: Probit estimates are for 2-year intervals. Standard errors in parentheses.
* Significant, from zero, at 10 percent level.
** Significant, from zero, at 5 percent level.
*** Significant, from zero, at 1 percent level.

Table 3.7

EFFECTS OF TECHNOLOGICAL CHANGE ON THE PROBABILITY OF TRAINING, BY SOURCE AND TYPE: CAREER WOMEN IN THE NLS

	Source of Training			Type of Training		
Educational Attainment	Company Training	Business and Technical Schools	Other Sources	Managerial	Professional and Technical	Clerical Training
Schooling <12 years	-15.968 (12.218)	-14.184 (34.298)	-16.084 ** (7.314)	-4.090 (231.742)	-31.436 ** (15.366)	-1.266 (19.064)
Schooling 12 years	-26.475 ** (10.210)	32.934 ** (15.941)	-17.349 *** (5.726)	-52.363 *** (14.528)	-30.165 *** (8.128)	1.996 (7.970)
Schooling 13-15 years	12.051 (11.649)	11.019 (57.907)	-11.984 (8.478)	28.358 * (17.170)	-5.956 (9.096)	5.296 (14.461)
Schooling 16 years	60.916 ** (30.968)	-0.144 (117.136)	-27.543 (21.719)	76.039 (56.766)	-19.942 (21.828)	-5.134 (90.961)
Schooling 17+ years	80.704 *** (26.109)	-66.865 (1682.919)	-97.568 * (55.354)	175.313 *** (14.685)	-91.023 (43.448)	94.234 (76.023)

NOTES: Standard errors in parentheses. Probit estimates are for 1-year intervals.
* Significant, from zero, at 10 percent level.
** Significant, from zero, at 5 percent level.
*** Significant, from zero, at 1 percent level.

Together, both these and previous results for regular school training provide important insights into the skill requirements that are associated with technological change. They make two points: first, that industries experiencing rapid technological change rely significantly more on training from in-house sources than on outside training, possibly because skills specific to new technologies are not readily available outside the firm; and second, that company training is especially prevalent among the most educated workers in high-tech firms, and training from outside sources the least common. Both results lend strong empirical support for Tan's (1980, 1986) model of technology-specific skills and Welch's (1970) hypothesis of the allocative efficiency of schooling.

Additional information about types of training are reported in the NLS surveys (see Tables 3.6 and 3.7). Two points stand out in comparing the likelihood of managerial and of professional and technical training across samples. First, high-tech firms are associated with a greater probability of managerial training, especially for the most educated workers. Second, professional and technical types of training are generally less prevalent in high-tech industries, but the relationship varies across different schooling groups in the three samples; it is significantly negative for the most educated youth and for the least educated women.

To what may we attribute these results? One intuitive explanation is suggested by the sources of these types of training. Employers provide just under half of all reported managerial training and only 15 to 30 percent of all professional and technical types of training.[6] Not implausibly, one may characterize managerial training as being more firm-specific, and professional and technical skills as being more general in nature, i.e., equally useful to a number of different employers. As technological change grows apace, requirements for more firm-specific

[6]Among young men, about 52 percent of managerial training and 30 percent of professional/technical training come from company sources. The corresponding proportions for mature men and career women are 48 and 30 percent, and 45 and 15 percent, respectively. Thus, between 50 and 85 percent of professional/technical training is provided by sources other than the employer.

(or technology-specific) managerial skills are also likely to rise relative to the demand for other general types of skills.

Other insights into the relationship between skill-specificity and technical change may be gleaned from questions in the CPS on the sources of training thought to be important (or needed) to get the current job. How transferable is training from prior jobs? Table 3.5 suggests that with a few exceptions, transferability of training from most sources is diminished when new jobs are found in industries characterized by high rates of technical change. In sharp contrast to the earlier finding, both men and women working in high-tech industries are significantly less likely to report that previous company training and informal OJT was important. Only among postgraduates--presumably the group most involved in R&D--is previous OJT important, i.e., transferable.

Clearly, the kinds of training information that we have explored here are capable of yielding important insights into the skill requirements needed for technological change.

Race

How likely are nonwhites to get training as compared with whites? We address this question in a limited way by including an indicator (0,1) variable, NONWHITE, in each probit estimate of training by source and type. Thus, for example, we do not explore race difference in training by schooling attainment or across high-tech and low-tech firms. That analysis would require estimating separate probit models for each ethnic group, a task beyond the scope of this study. Table 3.8 summarizes the net effects of race on the likelihood of training in the five surveys.

With few exceptions, nonwhite males are significantly less likely than white to get most kinds of post-school training, even after controlling for a comprehensive set of observable worker attributes, labor market experience, and job characteristics. This result is especially striking, and statistically significant, for company training and "other" training sources, and for managerial and professional/technical types of training. Interestingly, the race difference in training probability is quantitatively less pronounced for young men than for mature men in the NLS or, for that matter, males of all ages in the CPS.

Table 3.8

EFFECTS OF NONWHITE RACE ON THE PROBABILITY OF TRAINING, BY SOURCE AND TYPE

A. Source of Training

Group	Company Training	Informal OJT	Business and Technical Schools	Other Sources
CPS males	-0.250 ***	-0.012	n.a.	-0.226 ***
	(0.056)	(0.048)		(0.085)
CPS females	-0.142 ***	0.017	n.a.	-0.270 ***
	(0.054)	(0.045)		(0.081)
NLS young men	-0.168 ***	n.a.	0.041	-0.136***
	(0.044)		(0.051)	(0.046)
NLS men	-0.223 ***	n.a.	0.054	-0.029
	(0.069)		(0.183)	(0.052)
NLS career women	0.155	n.a.	0.250	0.138 *
	(0.132)		(0.347)	(0.080)

B. Type of Training

Group	Managerial	Professional and Technical	Semiskilled Manual	Clerical
NLS young men	-0.218 ***	-0.120 ***	0.037	n.a.
	(0.068)	(0.046)	(0.046)	
NLS men	-0.177 **	-0.181 **	n.a.	n.a.
	(0.087)	(0.073)		
NLS career women	0.205	-0.024	n.a.	-0.059
	(0.191)	(0.107)		(0.159)

NOTE: Standard error of probit estimates in parentheses.
* Significant, from zero, at 10 percent level.
** Significant, from zero, at 5 percent level.
*** Significant, from zero, at 1 percent level.

Race differences are less apparent for females. Among CPS women, nonwhites get significantly less company training, but the race differential is smaller than that for CPS men or for NLS youth. Among NLS career women, race is not an important factor in training. In fact, nonwhite women are more likely to get more training from both the employer and business and technical schools, as well as managerial training. However, only training from "other" sources is statistically significant at the 5 percent level.

These results should be of interest to researchers studying race differences in earnings. Numerous studies--for example, Smith and Welch (1984) and Smith (1978)--have documented the existence of earnings differentials among white and nonwhite males, and the absence of similar differences among females. Differences in training propensity of nonwhite males and females (relative to whites) highlighted by this analysis suggest one possible explanation for these empirical regularities.

Local and National Economic Conditions

A final issue is how local and national economic conditions affect the likelihood of post-school training. As noted earlier, we control for economic conditions in two ways. For the CPS, we use the state indices of labor market conditions developed by Lillard (1986). These include the state's long-run level of unemployment (SHAT), and the cyclic sensitivity of the state relative to national unemployment cycles (RHAT), both measured at the time a person joins the firm. For the NLS, no state information is available, so we use the national unemployment rate (NUR) as an aggregate measure of labor market conditions. Table 3.9 summarizes the effects of these variables on training probability.

The likelihood of getting training drops in local labor markets characterized by persistently high unemployment rates or greater cyclical volatility relative to the nation as a whole. These effects are generally significant for training from in-house sources, informal OJT in particular, but never for training outside the current firm. These results are what one might expect if employment in states with high values of SHAT and RHAT is concentrated in declining industries, or

Table 3.9

EFFECTS OF ECONOMIC CONDITIONS ON THE PROBABILITY OF TRAINING, BY SOURCE AND TYPE

A. Source of Training

Unemployment Variable	Company Training	Informal OJT	Business and Technical Schools	Other Sources
CPS males				
SHAT	-2.615	-5.977 **	n.a.	-4.001
	(2.488)	(2.447)		(3.352)
RHAT	-0.234 ***	-0.136 ***	n.a.	-0.083
	(0.042)	(0.039)		(0.059)
CPS females				
SHAT	-0.629	-9.384 ***	n.a.	-4.183
	(2.746)	(2.659)		(3.675)
RHAT	-0.199 ***	-0.089 **	n.a.	-0.067
	(0.048)	(0.043)		(0.059)
NLS young men				
NUR	-0.002	n.a.	0.011	0.007
	(0.012)		(0.013)	(0.012)
NLS men				
NUR	0.014 ***	n.a.	0.014	0.013 ***
	(0.005)		(0.015)	(0.004)
NLS career women				
NUR	0.111 *	n.a.	0.040	-0.083 **
	(0.058)		(0.154)	(0.035)

B. Type of Training

Unemployment Variable	Managerial	Professional and Technical Training	Semiskilled Manual	Clerical
NLS young men				
NUR	-0.013	0.015	0.010	n.a.
	(0.017)	(0.010)	0.013)	
NLS men				
NUR	0.008	0.023 ***	n.a.	n.a.
	(0.006)	(0.005)		
NLS career women				
NUR	-0.231 ***	0.148 ***	n.a.	-0.078
	(0.088)	(0.045)		(0.065)

NOTE: See text for definitions of SHAT, RHAT, and NUR.
* Significant, from zero, at 10 percent level.
** Significant, from zero, at 5 percent level.
*** Significant, from zero, at 1 percent level.

in firms with cyclically sensitive product demand. If layoff rates are high as a consequence, both employers and workers have few incentives to either provide or take company training in job-specific skills, since there is little probability of recouping training costs.

In the NLS, where the national unemployment rate (NUR) is used, a different pattern of training effects is observed. For mature men and career women, periods of high national unemployment are associated with a greater likelihood of training from company sources, especially professional and technical types of training, while no significant effects are found for young men. One possible interpretation is that employers are more likely to retrain older workers during periods of slack economic activity when the opportunity cost of their time is low. The apparent contradiction between the two kinds of training effects is more apparent than real. They measure different phenomena: SHAT and RHAT, the effects of persistent local labor market conditions; NUR, the marginal effects of changing economic condition on training, given persistent differences in local labor market conditions.

TRAINING AMONG THE DISADVANTAGED

Up to now, we have focused on training taken by nationally representative samples of the population (CPS men and women) and by several distinct demographic groups (the three NLS cohorts). We now turn to the analysis of training among the economically disadvantaged EOPP sample.

We noted earlier that a significantly smaller proportion of the EOPP sample reported getting training, especially OJT, as compared with other groups in the CPS and NLS. Moreover, their training patterns resembled that of women with intermittent labor force participation. These observations suggest several relationships that may explain the low likelihood of training among the economically disadvantaged: low levels of schooling, racial discrimination, and weak labor force attachment.

To address some of these hypotheses, we estimated separate probit models for training from three sources: OJT, business and vocational schools, and miscellaneous other sources including participation in

government sponsored programs. In each, we related the probability of training to a set of covariates that included educational attainment, years of work experience, time not working, and number of jobs held since January 1979 (over an interval of about 18 months). In addition, we included an indicator (0,1) variable to distinguish individuals belonging to "low-income" households from the nonpoor control group, as well as a race (NONWHITE) dummy variable.[7] Finally, we controlled for union membership when it was known. These probit estimates are reported in Table 3.10.

Several results are suggested by the probit estimates. First, they confirm what was revealed by simple tabular analysis, namely, that members of the low-income group are significantly less likely to get OJT from employers than people in the control population. No differences are found in the prevalence of training from other sources. Second, in striking contrast to the results for other samples (see Table 3.8), the coefficient of the nonwhite variable is not statistically significant. Thus, being black *per se* is not associated with a lower likelihood of training; being a member of the low-income group, and having traits associated with a high incidence of unemployment or low income, is. Finally, whatever these (unobserved) factors are, they also appear to diminish the positive effects of schooling on training. Though the likelihood of training rises with educational attainment, these effects are very small as compared with other groups in the CPS and NLS.

Several other relationships between training and labor market experience are suggested in Table 3.10. The likelihood of training declines with years in the labor force, and with time not working since January 1979 for OJT and training from other sources. The latter is likely to be particularly important for the low-income group (and presumably for women as well), who are more likely to experience spells of unemployment or to exit and enter the labor market frequently. Contrary to our priors, the number of job changes was associated not with a lower likelihood of training, as might be expected if it

[7]Participation in the EOPP was not random; to be eligible, individuals had to meet the eligibility requirements of being unemployed and being either below a given family income (twice the poverty level for a given family size) or on AFDC or SSI.

Table 3.10

PREVALENCE OF TRAINING BY SOURCE AMONG DISADVANTAGED WORKERS EOPP SAMPLE

Variable	Source of Training: OJT	Source of Training: Business and Vocational Schools	Source of Training: Other Sources
Intercept	0.037 (0.005)	0.071 (0.006)	0.054 (0.007)
Low-income group	-0.007 ** (0.003)	-0.005 (0.004)	-0.002 (0.005)
Nonwhite	0.0001 (0.004)	-0.004 (0.005)	-0.0010 (0.005)
Schooling <12 years	-0.009 ** (0.004)	-0.026 *** (0.005)	-0.005 (0.005)
Schooling 13-15 years	0.017 *** (0.005)	0.016 ** (0.006)	0.024 *** (0.006)
Schooling 16 years	0.023 *** (0.006)	-0.015 * (0.008)	0.036 *** (0.008)
Schooling >17 years	-0.0003 (0.007)	-0.037 *** (0.008)	0.057 *** (0.009)
Years of work experience	-0.0005*** (0.0001)	-0.001 *** (0.0002)	-0.0009*** (0.0002)
Time not working	-0.001 ** (0.0005)	-0.0003 (0.0006)	-0.002 ** (0.0007)
Missing time	-0.010 (0.010)	-0.012 (0.012)	-0.025 * (0.013)
Union member	0.008 ** (0.003)	-0.006 (0.004)	-0.0005 (0.005)
Missing union	-0.012 * (0.006)	-0.016 * (0.008)	0.010 (0.008)
No. jobs since 1/1/79	0.003 (0.002)	0.009 *** (0.002)	0.008 *** (0.002)

NOTE: Probit specification. Standard errors reported in parentheses.

* Significant, from zero, at 10 percent level.

** Significant, from zero, at 5 percent level.

*** Significant, from zero, at 1 percent level.

accurately proxied weak job attachment, but rather with significantly higher training from business/vocational schools and from other sources. In part, this may simply reflect quits or voluntary job changes not associated with an unemployment spell (since we are controlling for time not working) to pursue training from sources outside the firm.

SUMMARY

In this section, we investigated several determinants of training to shed light on the reasons for observed differences in the amounts and kinds of training received by various demographic groups. We identified four important factors.

First, a higher level of educational attainment increases the likelihood of training, though the quantitative effects on training vary considerably across demographic groups and, within groups, across different kinds of training. These schooling effects are smaller for women than for men, and especially so for the disadvantaged group as a whole.

Second, schooling is also related to training through its interaction with the rate of technological change in the current job. The likelihood of getting company and informal OJT is greater in industries experiencing rapid technological change, especially for the most educated workers. This result holds equally for both men and women. Moreover, the demand for in-house and managerial training increases relative to general types of training from external sources when the pace of technological change is high.

Third, nonwhite males are significantly less likely than whites to get most kinds of training. Interestingly, however, these racial differences in training are not apparent among females, or among the disadvantaged sample.

Finally, the evidence suggests that training is diminished in states characterized by persistently high levels of unemployment or by greater cyclical volatility in unemployment relative to the nation as a whole.

IV. THE ECONOMIC CONSEQUENCES OF TRAINING

Up to now, we have painted a broad picture of the overall patterns and determinants of training among various groups in the population. We now turn to an empirical analysis of the effects of training on earnings, earnings growth, and employment stability. In particular, we are interested in identifying the sources and types of training that are importantly related to the outcomes of interest, and in estimating the duration of such effects.

While we are critically aware that the decision to offer or to receive training may be endogenous and thus subject to "self-selection" problems,[1] we do not treat the issue here econometrically, simply because the issue is more difficult than the scope of this research project permits us to consider. Many of the issues are discussed in Lillard and Kumbhakar (1986). The primary difficulty is the treatment of multiple occurrences of multiple training sources and types, and of their locations in time. These issues have not been raised in the literature, much less solved. The availability of panel data from the NLS makes the empirical relevance of these issues obvious. Our approach in this section is to document the importance of dynamic patterns in training for use in the development of future econometric models, and to treat these training sequences as if they were exogenous for the current specifications.

In the analysis, we focus on men and women in the 1983 CPS and in the NLS Young Men cohort. Of the surveys considered so far, these two have the most complete information on previous training history, but even they have limitations.[2] The CPS is a cross-sectional survey with current annual and weekly earnings data and retrospective data on

[1]For example, see Willis and Rosen (1979), Keifer (1979), and Ashenfelter (1978).

[2]For both women and mature men in the NLS, the analysis of training effects is severely limited by the absence of information on training taken prior to the first survey in 1966. The problem of incomplete training histories is particularly acute for mature men, all of whom had been in the labor force for at least 25 years prior to the time when we first observe them.

multiple sources of training both to get the current job and to improve current job skills, but without any information on either the number of such events or their timing. On the other hand, the NLS Young Men data contain annual earnings most years of the panel, but information on weekly earnings only in some selected years. Training information is available for every survey period, but multiple sources or types of training within a period are not known, only the longest is. These caveats, and those pertinent to endogenous training choices noted above, should be kept in mind in the analyses that follow.

We begin with an examination of the effects of training on earnings of men and women in the CPS. Next, we estimate earnings models for the NLS sample of young men, including dynamic training effects, which we treat as predetermined. This is followed, again for the NLS sample, by an analysis of the impact of training on the likelihood of unemployment and, conditional on unemployment, on weeks unemployed. We conclude with a summary of the main findings.

THE 1983 CURRENT POPULATION SURVEY (CPS)

The analysis of training outcomes is based on earnings and weeks worked over the previous year reported in the March 1983 CPS. We are able to do this by merging the January and March CPS files. The sample is restricted to males who report positive earnings and weeks worked the previous year. We exclude the self-employed, those currently unemployed during the survey week (they are included in the subsequent analysis of unemployment as a training outcome), and those with such low earnings (weekly wages less than $10) that we presume their earnings are incorrectly recorded. Finally, we exclude individuals who entered the firm of current employment prior to 1960. This was motivated by our concern over possible recall error regarding training taken some 23 or more years earlier. This resulted in a sample with 11,202 observations.

Two specifications of a wage model are used to study the effects of training on earnings. The first is the conventional wage model typically estimated in the human capital literature, where the logarithm of annual earnings is related to educational attainment, potential work experience, job tenure, and controls for a variety of demographic and locational variables and job and local labor market characteristics. In

the second specification, we include additional variables for reported training. These wage models are estimated by ordinary least squares (OLS), and the results reported in Table 4.1.[3]

Column one of Table 4.1 presents the estimates for the first model specification. The results are broadly similar to those reported elsewhere in the literature and will be summarized only briefly here. The returns to schooling are on the order of about 11 percent.[4] The effect of experience prior to joining the firm of current employment, while significantly positive, is small (0.7 percent) compared with that of job tenure (which has a linear effect of about 15 percent). The control for low work experience is significantly negative, indicating that the earnings profile rises quite steeply in the first five years in the labor market. Nonwhites, people living outside the western United States (the omitted region), and those working in nonunionized firms receive lower earnings.

The results also indicate that the returns to schooling are higher if the individual worked in a high-technology industry. This result is indicated by the positive interactions between schooling categories and the measure of industry rates of technical change. The parameters of these interactions are larger and more statistically significant for the higher schooling categories. To illustrate, note that the effect is two to three times larger for those with advanced degrees than for high school graduates. This finding provides support for the allocative efficiency hypothesis that better educated workers are more adept at responding to technological change (Welch, 1970; Tan, 1980).

The results of the second model specification suggest that several reported measures of training are associated with higher earnings. In

[3]A similar set of estimates for weekly earnings is reported in the Appendix tables. Differences between the annual and weekly earnings estimates reflect labor supply effects, that is, the effects of variations in weeks worked last year. Because the results appear to be broadly similar, the following discussion focuses on the annual earnings figures.

[4]A continuous measure of educational attainment is used because years of schooling appeared to have a linear effect on earnings in an alternative specification where schooling was entered as categorical variables.

Table 4.1

THE EARNINGS AND TRAINING EQUATIONS FOR CPS MEN

Variable	Model specification (1)	(2)	(3)
Constant	7.598 (.062)	7.871 (0.065)	7.858 (0.067)
Years of schooling	0.111 *** (0.003)	0.083 *** (0.003)	0.079 *** (0.004)
Nonwhite	-0.239 *** (0.026)	-0.219 *** (0.026)	-0.200 *** (0.025)
South region	-0.022) (0.021)	-0.023 (0.021)	-0.010 (0.021)
North East region	-0.142 *** (0.025)	-0.133 *** (0.024)	-0.117 *** (0.024)
North Central region	-0.091 *** (0.022)	-0.086 *** (0.021)	-0.077 *** (0.021)
SHAT (long-run state unemployment rate)	-0.138 (1.571)	0.375 (1.550)	0.766 (0.534)
RHAT (cyclical sensitivity of state unemployment)	0.126 *** (0.029)	0.138 *** (0.029)	0.127 *** (0.028)
Union member	0.160 *** (0.026)	0.184 *** (0.026)	0.181 *** (0.025)
Union missing	-0.003 (0.019)	0.008 (0.016)	0.006 (0.015)
First 5 years of work	-0.458 *** (0.021)	-0.457 *** (0.020)	-0.436 *** (0.020)
Prior work experience	0.007 *** (0.001)	0.007 *** (0.001)	0.006 *** (0.001)
Years of job tenure	0.152 *** (0.004)	0.144 *** (0.004)	0.142 *** (0.004)
Tenure squared	-0.005 *** (0.0002)	-0.005 *** (0.000)	-0.005 *** (0.0002)
Technological change interaction Schooling <12 years	-0.377 (1.558)	-0.942 (1.536)	-0.705 (1.522)

Table 4.1--continued

Variable	Model specification (1)	(2)	(3)
Schooling 12 years	3.635 ***	4.363 ***	4.746 ***
	(1.088)	(1.074)	(1.063)
Schooling 13-15 years	2.352 *	3.035 **	3.131 **
	(1.469)	(1.451)	(1.439)
Schooling 16 years	6.883 ***	6.411 ***	6.364 ***
	(1.808)	(1.784)	(1.767)
Schooling 17+ years	9.161 ***	8.808 ***	8.164 ***
	(2.332)	(2.304)	(2.281)
Training to improve skills			
Regular school		0.021	0.014
		(0.024)	(0.024)
Company		0.270 ***	0.224 ***
		(0.021)	(0.021)
On-the-Job		0.056 ***	0.044 **
		(0.020)	(0.020)
Other		0.135 ***	0.112 ***
		(0.035)	(0.035)
Training to get job			
Regular school * years of schooling		0.014 ***	0.021 ***
		(0.001)	(0.008)
Regular school			-0.099
			(0.123)
Company			0.176 ***
			(0.023)
On-the-Job			0.198 ***
			(0.016)
Other			-0.012
			(0.027)
R-square	.362	.380	.3934

SOURCE: 1983 CPS.
NOTE: Standard errors in parentheses.
* Significant, from zero, at 10 percent level.
** Significant, from zero, at 5 percent level.
*** Significant, from zero, at 1 percent level.

column two, which includes training to improve job skills from each of the sources, company training has the largest effect on earning (27 percent), followed by training from "other" sources (13 percent). Oddly, informal OJT has only a small (though significant) earnings effect of about 5 percent. The effect of regular school training is statistically insignificant. However, schooling returns are higher if the individual reported that regular school training was important in getting the current job. The coefficient of the interaction between these two variables varies between 1.5 and 2.0 percent, or about one-sixth to one-quarter the estimated returns to schooling.

When measures of training to get the current job are included (column three), the estimated effects of training to improve fall, but only marginally. Of the training reported as needed, several training sources proved to be important: company training and OJT from previous jobs had a statistically significant effect on earnings in the current job. It thus appears that many respondents accurately perceive that some of their prior skills are transferable to other jobs, and report accordingly. For these individuals, at least, the results indicate that previous company training and informal OJT are quite portable: Their effects on earnings in the current job (between 17 and 20 percent) are not too different from the returns to company training on the current job.

The CPS results, while informative, nonetheless are limited by the cross-sectional nature of the data and the kinds of training questions asked. The reporting of only two training events in the CPS (when our earlier results indicate that multiple training events are common), and the lack of information on when training to improve skills was taken, limits our ability to estimate appropriately the effects of training on earnings. In particular, we are unable to identify the time path of these effects on earnings. Do the earnings effects of training persist or are they dissipated over time? Are there variations in these effects among the different kinds of training?

THE NATIONAL LONGITUDINAL SURVEY OF YOUNG MEN (NLS)

The panel nature of the NLS Young Men data allows us to investigate the effect of training in greater depth. In what follows we describe the econometric specification of the earnings equation, including dynamic training effects--treated as predetermined. We also describe in detail the construction of the measured training variables which follow from the econometric specification. Then we report the main findings.

First, consider the earnings and training information available for the NLS Young Men. We created a data set that pooled data across five years: 1969, 1973, 1975, 1978, and 1980. These survey years were selected because (relatively) clean data were available on both wage and salary income and weeks worked in the past year, from which the dependent variables--the logarithm of annual earnings and weekly wages--can be calculated.[5]

The samples for each survey year included those who worked sometime in the past year and reported positive earnings. Those currently unemployed at the time of the survey were also excluded (they are included in the next section, where training effects on weeks unemployed are investigated). This yielded the following sample sizes for each of the survey years:

1969 = 2663	1973 = 3067	1975 = 2978
1978 = 2693	1980 = 2605	

for a total pooled sample of just over 14,000 observations.

The Earnings Equation

We begin with a fairly standard specification of the earnings equation in the absence of training. It is similar to the equation used for the CPS data in terms of the vector of explanatory variables, X. However, we now introduce panel data in which individuals are observed repeatedly over time. Denote annual earnings (log) or the weekly wage

[5]The computed weeks-worked variable in the other years was not considered reliable: The algorithm produced a large number of respondents who worked more than 52 weeks in the past year.

(log) of individual i in period t by Y(i,t), and similarly the vector of regressors, X(i,t). Implicitly, the regression function Y(i,t) = X(i,t)*b + U(i,t) involves individual life-cycle earning or wage paths, including potential experience and tenure on the job, which depend on X. For a fuller treatment of these notions, see Lillard (1985), and Lillard and Willis (1978).

The point of departure here is that earnings in the current period may be affected in a number of ways by training. First, training in the current period may actually reduce earnings through reduced productivity during the learning period if the training occurs on the job or requires leaving the job, as in the case of going to school or training classes. Even if training does not directly reduce earnings, earnings may be less in the current period if the training is completed in the middle of the earnings interval and only increases earnings upon completion.

Second, the occurrence of the event of current and past training may simply shift the earnings function up (presumably) by some proportion. We assume for simplicity that each occurrence of training enhances earnings by the same amount. Each source or type of training may have a different effect on earnings.

Third, the occurrence of training may alter the wage or earnings growth rate of the worker permanently. In this case the effect of a training event will depend on how long ago it occurred, the duration since training, since at that point in the past the growth path was changed. Again each source or type of training may have a different effect. One may presume that training will enhance the growth of earnings or wages.

An alternative model of the effect of training may be couched in these same terms. That is, training may enhance earnings only temporarily, with an initial increase that deteriorates over time. Then the effect on earnings growth would be negative in the immediate period after the initial increase. This may be an appropriate interpretation if the work environment is rapidly changing or if the worker is more and more likely over time to change jobs, either within or between firms, so that the training becomes less valuable.

In accordance with these notions, we define three training variables for their effect on earnings in the current period: (1) whether training was taken since the previous interview, termed "current"; (2) the accumulated sum of all training events taken since 1967 or whenever the individual first began work as a major activity, termed "events"; and (3) the duration of time between getting training and the current period, accumulated over all training events, termed "duration." These three measures provide a parsimonious way of characterizing the effects of multiple episodes of training on earnings. Separate training measures are calculated for each source and type of training.

We provide below summary descr[illegible] these training measures for the first and last years in the [illegible]ample: 1969 and 1980. To read these tables, consider the three [illegible]sures of training in Panel A of Table 4.2. The first row--for current training--shows that 19.3 percent of the 1969 sample got some kind of training in the previous year. The second row--the cumulated number of training events--shows that 68.9 percent had not received any training by 1969, 22.2 percent reported one training event, and almost 9 percent got two or more training events. The third row shows the total duration of time since training. Since a total of three events may be reported, one for each of the years 1967 to 1969, the maximum duration summed across all events is 6 years. In Panels B and C, these measures are reported by source and type for selected kinds of training.

The second set of training measures is for 1980, the last year of the pooled sample. Compared with the first year, individuals in this sample may report an additional 7 training events, for a maximum of 10. From Panel A, note that the proportion without any training falls (from 69 percent in 1969) to about 27 percent by 1980. Almost half have between 2 and 5 training events, and over 6 percent have 6 or more. For these latter groups, the duration of time since training can be in excess of 11 years (exceeding 50 years for some). When cumulated training is disaggregated by source and type, repeated training (2 to 5 events) is most common from company training programs and other school sources, and for professional, technical and semiskilled training types.

Table 4.2

SUMMARY MEASURES OF TRAINING TAKEN BY NLS YOUNG MEN BY 1969 AND 1980; SELECTED SOURCES AND TYPES OF TRAINING

Training Measures	By 1969 Distribution of Years (%) 0	1	2-3	4-5	6	By 1980 Distribution of Years (%) 0	1	2-5	6-10	11+
A. Any training										
Current	80.7	19.3				68.5	31.5			
Events	68.9	22.2	8.9			26.9	21.0	46.0	6.1	
Duration	68.9	12.0	14.9	2.1	2.1	26.9	4.5	9.6	13.3	45.7
B. Source of training										
Company Training										
Current	93.9	6.1				86.2	13.8			
Events	88.6	9.4	2.0			63.7	19.9	15.5	0.9	
Duration	88.6	4.5	6.0	0.6	0.3	63.7	5.5	7.8	8.2	14.8
Business and technical										
Current	97.1	2.9				95.7	4.3			
Events	95.1	3.8	1.1			78.3	15.1	6.5	0.1	
Duration	95.1	2.1	2.4	0.3	0.1	78.3	2.4	4.1	8.4	6.8
C. Type of training										
Managerial										
Current	98.1	1.9				94.4	5.6			
Events	96.6	2.9	0.5			83.4	11.3	5.1	0.2	
Duration	96.6	1.6	1.6	0.1	0.1	83.4	3.1	4.5	3.3	5.7
Professional-technical										
Current	93.0	7.0				85.5	14.5			
Events	89.5	8.8	1.7			60.0	20.7	18.7	0.6	
Duration	89.5	5.7	4.3	0.4	0.1	60.0	5.3	4.9	11.7	18.1

Note: Training from regular schools and "other" sources excluded, as are semi-skilled manual, clerical and "other" types of training.

This characterization of training forms the basis of our analyses of the effects of training on earnings. In the following section, we estimate wage models, where we relate annual earnings and weekly wages to the three training measures, controlling for personal and firm attributes, location, and labor market conditions. In addition, we include year dummy variables to capture shifts in earnings over time relative to 1980, the omitted year. We also report the findings of separate analyses of the effects of training by source and by type of training. The variables used, their definition, and summary statistics are reported in the Appendix.

Earnings Results for NLS Young Men

Table 4.3 presents the results of estimating two variants of the model: column one for the conventional wage model, column two for the specification with the training variables.

Many of the results are familiar and consistent with findings reported elsewhere in the extensive human capital literature on earnings. Earnings exhibit the familiar quadratic shape, rising rapidly with both years of work experience and job tenure, but at a slower pace at higher levels of experience. Because this quadratic form may not capture the steep rise in initial earnings, we included an indicator variable for being in the first 5 years in the labor force. Its effect, however, is negative only for the weekly wage variant, and is never statistically significant. Those in the South earn 9 to 12 percent less than in other regions, as do blacks whose earnings are between 19 and 24 percent less than those of other racial groups.

Like the results for the CPS sample, schooling and its interactions with technical change have the expected effects on earnings. Earnings rise with level of schooling completed, especially for the most educated individuals with college or advance degrees in industries experiencing rapid technological change.

The estimates including the training variables are reported in the second column of Table 4.3. The training variables have the postulated effects on earnings. Training taken in the current period is associated with an initial (and one-time) drop in earnings of 2.4 percent. In

Table 4.3

EARNINGS AND ANY-TRAINING EQUATIONS

Variable	(1)	(2)
Constant	8.735	8.708
	(0.047)	(0.047)
1969 year dummy	-1.040	-1.012
	(0.022)	(0.023)
1973 year dummy	-0.601	-0.592
	(0.020)	(0.020)
1975 year dummy	-0.439	-0.429
	(0.019)	(0.019)
1978 year dummy	-0.168	-0.173
	(0.018)	(0.018)
Nonwhite	-0.245	-0.230
	(0.014)	(0.014)
Schooling <12 years	-0.199	-0.159
	(0.019)	(0.019)
Schooling 13-15 years	0.099	0.077
	(0.016)	(0.016)
Schooling 16 years	0.296	0.273
	(0.020)	(0.020)
Schooling 17+ years	0.392	0.369
	(0.019)	(0.019)
Prior work experience	0.110	0.100
	(0.006)	(0.006)
Experience squared	-0.004	-0.003
	(0.000)	(0.000)
First 5 years of work	0.005	0.006
	(0.024)	(0.024)
Years of job tenure	0.096	0.092
	(0.004)	(0.004)
Tenure squared	-0.005	-0.004
	(0.001)	(0.000)
Tenure missing	0.233	0.234
	(0.038)	(0.033)

Table 4.3--continued

Variable	(1)	(2)
South dummy variable	-0.099 (0.012)	-0.095 (0.012)
Local unemployment rate	-0.002 (0.003)	-0.002 (0.003)
Unemployment rate missing	-0.047 (0.022)	-0.052 (0.022)
Technical change interaction		
Schooling <12 years	-1.833 (1.163)	-2.092 (1.153)
Schooling 12 years	-0.817 (0.843)	-0.390 (0.836)
Schooling 13-15 years	-0.139 (1.023)	0.399 (1.015)
Schooling 16 years	6.382 (1.481)	6.352 (1.468)
Schooling 17+ years	8.414 (1.554)	8.277 (1.541)
Any training		
Current		-0.024 (0.019)
Events		0.119 (0.012)
Duration		-0.011) (0.002)

SOURCE: NLS Young Men.
NOTE: Standard errors in parentheses.

every subsequent year, however, training has two effects on earnings: an 11.9 percent increase in earnings level (the coefficient of the cumulated training variable), and a 1.1 percent decline with each year since training (the duration coefficient). Thus, the net effect of

training is an increase of 9.5 percent (11.9 - 2.4) in the first year, 10.8 percent (11.9 - 1.1) in the second year, and a decline to zero by the 11th year after training.

How do these time effects of training vary across training from different sources? Panel A of Table 4.4 summarizes the earnings effects of training, disaggregated by training taken in a company program, in business and vocational schools, in regular schools, and from other sources. The regression results on which these estimates are based are reported in the Appendix. Several striking differences become apparent in comparing the effects of the different kinds of training in the earnings regressions. First, company training has the largest effect on earnings (16 percent), followed by training from business and vocational schools (11 percent), and over 8 percent from regular schools and other sources. Second, company training is characterized by almost no decline in initial period earnings as compared with a 10 percent fall for those getting training in business and vocational schools. Finally, the rate of decay in training effects on earnings is very similar across kinds of training, varying between 1 and 1.3 percent per year.[6]

Panel B of Table 4.4 reports the results of estimating the wage models including type of training. Similar kinds of training effects are found here. Taking training in the current period has negligible effects on earnings for managerial and for professional and technical training, and somewhat larger negative effects on semiskilled manual training. The initial effects of the former types of training are larger (14 to 16 percent) than the 9.5 percent for semiskilled training. However, because the rate of decay of semiskilled training is lower, the earnings effects of this type of training persist over a longer period (15 years) as compared to 12 and 11 years for managerial and professional/technical training, respectively. The earnings effects of other types of training are short-lived, lasting no more than 7 years.

The time paths of the earnings effects of different sources and types of training are summarized in Table 4.5. Because of the points noted above, the positive effects of company training on earnings

[6]A similar, but more pronounced, pattern of training effects is found in the weekly wage set of estimates. (See Appendix.)

Table 4.4

EFFECTS OF TRAINING ON ANNUAL EARNINGS OF NLS YOUNG MEN BY SOURCE AND TYPE OF TRAINING

A. Source of Training				
Training Variable	Regular School	Business and Technical School	Company Training	Other Sources
Current	-0.046 (0.039)	-0.109 ** (0.038)	0.000 (0.029)	-0.008 (0.028)
Events	0.082 ** (0.031)	0.119 *** (0.029)	0.169 *** (0.020)	0.088 *** (0.020)
Duration	-0.010 ** (0.004)	-0.013 *** (0.004)	-0.013 *** (0.003)	-0.009 *** (0.003)
B. Type of Training				
Training Variable	Managerial	Professional and Technical	Semi-skilled	Other Types
Current	0.016 (0.046)	-0.011 (0.028)	-0.061 * (0.031)	-0.025 (0.033)
Events	0.166 *** (0.035)	0.142 *** (0.021)	0.096 *** (0.020)	0.101 *** (0.026)
Duration	-0.014 *** (0.005)	-0.013 *** (0.003)	-0.007 ** (0.003)	-0.015 *** (0.004)

SOURCE: The estimates are reported in full in the Appendix.
NOTE: Standard errors in parentheses.
* Significant, from zero, at 10 percent level.
** Significant, from zero, at 5 percent level.
*** Significant, from zero, at 1 percent level.

Table 4.5

TIME PATH OF TRAINING EFFECTS ON ANNUAL EARNINGS OF NLS YOUNG MEN

A. Source of Training and Percent Increase in Earnings

Years Since Taking Training	Company Training	Business and Technical	Regular School	Other Sources
Current period	16.8	1.1	3.5	8.0
1 year	15.5	10.6	7.1	7.8
3 years	12.8	7.9	5.0	6.0
6 years	8.8	3.9	1.9	3.2
9 years	4.8			0.5
12 years	0.8			
Duration of positive training effects	13 yrs	9 yrs	8 yrs	10 yrs

B. Type of Training and Percent Increase in Earnings

Years Since Taking Training	Managerial	Professional and Technical	Semiskilled Manual	Other Types
Current period	18.2	13.1	3.5	7.6
1 year	15.2	12.9	8.9	8.6
3 years	12.4	10.3	7.5	5.6
6 years	8.2	6.4	5.4	1.1
9 years	4.0	2.5	3.3	
12 years			1.2	
Duration of positive training effects	12 yrs	11 yrs	15 yrs	7 yrs

SOURCE: Table 4.4.

persist for 13 years, as compared with 8 to 10 years for the other sources of training. Also note the markedly lower initial earnings when training is taken from regular schools or business and vocational schools. This may simply reflect earnings forgone in diverting work time to attending school. However, these results hold even when we control for weeks worked in the past year. Are employers providing workers with these external sources of general training, and having them

pay for it through lower weekly wages? If so, then this view also suggests that employers pay for training taken within the company, which (presumably) is firm-specific.

THE EFFECTS OF TRAINING ON UNEMPLOYMENT

Here we investigate a second training outcome, employment stability, using the NLS Young Men sample. The issue is whether training reduces the likelihood of unemployment. Several other research questions are also of interest here. Are some kinds of training, such as company training, more effective than others in cementing worker-firm job attachment, as suggested by the literature on firm-specific human capital? Just as trained workers earn more, are they also persistently less likely to be unemployed, or do training effects change over time? Finally, how important are the labor displacement effects of technological change?

For the analysis, we use the 1969 and 1980 NLS surveys, in which NLS respondents are asked directly about weeks unemployed in the previous year. In other years, this variable was thought to be less reliable, because it was constructed from information on previous work history (a similar problem was encountered in the earnings analyses). For the analysis of unemployment probability, only individuals without missing data on the weeks-unemployed question were included in the analysis samples. This selection criterion resulted in a total pooled sample of 6114 observations: 2954 in 1969 and 3160 in 1980.

The Probability of Unemployment

The effects of training on unemployment are investigated using a probit model. The dependent variable is a dichotomous variable with a value of 1 if an individual is either currently unemployed or has been unemployed sometime over the past year, and 0 otherwise. This variable is related to the vector of explanatory variables used in the previous analysis of earnings. As before, these include the three measures of training: training in the "current" period, accumulated training "events," and "duration" since training.

Table 4.6 presents the maximum likelihood probit estimates of the determinants of unemployment propensity. The first column, which reports the estimates for the basic model, provides a benchmark for comparison with the other models which include training variables. Column two reports the results for having taken any vocational training.

Several results suggested by Table 4.6 resemble findings reported by other research on the determinants of unemployment. First, the likelihood of unemployment is lower for the more educated, and for whites than for other racial groups. Second, those with less than five years of labor market experience are more likely to experience unemployment, but this declines with increasing years of job tenure (see Mincer and Jovanovic, 1981). Third, as might be expected, individual probabilities of unemployment rise with the national unemployment rate.

A final result, which is novel, is the absence of any relationship between technological change and the likelihood of unemployment. Unlike the previous results for earnings, the interactions between technological change and schooling are not statistically significant except for the negative interaction for high school graduates. We interpret this finding to mean that a higher industry rate of technological change in the current or last job is not associated with a greater incidence of unemployment, or, in other words, that concerns over the labor displacement effects of technical change are not warranted.

The effects of training on the probability of unemployment mirror the effects of training on annual earnings. The estimates in column two suggest that vocational training is associated with a decline in the likelihood of unemployment, an effect that persists for approximately 12 years. As before, the period over which training effects attenuate can be calculated from the parameters of the cumulated training and training duration variables, i.e., -0.240/0.019.

The unemployment effects of training vary systematically by source (Panel A) and type of training (Panel B), as is evident in Table 4.7. The probit results on which these estimates are based are reported in full in the Appendix. They suggest that of all the different sources of training, company training has the most enduring effect on reducing the

Table 4.6

EFFECTS OF ANY TRAINING ON UNEMPLOYMENT PROBABILITY: NLS YOUNG MEN SAMPLE

Variable	(1)	(2)
Constant	-1.119 ***	-1.097 ***
	(0.099)	(0.102)
Schooling <12 years	0.176 ***	0.137 **
	(0.065)	(0.066)
Schooling 13-15 years	-0.126 **	-0.097 *
	(0.058)	(0.058)
Schooling 16 years	-0.506 ***	-0.479 ***
	(0.088)	(0.089)
Schooling 17+ years	-0.601 ***	-0.581 ***
	(0.078)	(0.079)
Technological change interaction		
Schooling <12 years	-1.496	-1.264
	(4.167)	(4.186)
Schooling 12 years	-6.084 *	-6.065 *
	(3.141)	(3.142)
Schooling 13-15 years	-3.674	-4.920
	(4.081)	(4.052)
Schooling 16 years	2.322	1.720
	(7.838)	(7.943)
Schooling 17+ years	-10.098	-10.145
	(7.066)	(7.238)
Nonwhite	0.328 ***	0.318 ***
	(0.051)	(0.051)
South region dummy	-0.201 ***	-0.210 ***
	(0.047)	(0.048)
Prior work experience	-0.001	-0.002
	(0.006)	(0.006)
First 5 years of work	0.207 ***	0.148 **
	(0.066)	(0.068)
Years of job tenure	-0.117 ***	-0.116 ***
	(0.006)	(0.006)

Table 4.6--continued

Variable	(1)	(2)
Tenure missing	1.575 ***	1.563 ***
	(0.081)	(0.081)
National unemployment rate	0.079 ***	0.099 ***
	(0.017)	(0.018)
Any training		
Current		0.198 **
		(0.082)
Events		-0.240 ***
		(0.056)
Duration		0.019 ***
		(0.007)

SOURCE: NLS Young Men 1969, 1980.
NOTE: Probit Specification. Standard errors in parentheses.
* Significant, from zero, at 10 percent level.
** Significant, from zero, at 5 percent level.
*** Significant, from zero, at 1 percent level.

likelihood of unemployment (12.8 years), followed closely by training from "other" sources (12.3 years). In contrast, the effects of training from regular school sources disappear within 7 years. Training from business and vocational schools was not significant in inhibiting unemployment. The effects of training on unemployment also vary by type of training (Panel B). Professional and technical training reduces the likelihood of unemployment the most, but because this effect attenuates rapidly over time, training effects only persist over 11.8 years. The effects of semiskilled manual and other types of training last between 12.2 and 10.7 years, respectively. Managerial training did not have a significant effect in reducing the likelihood of unemployment.

Table 4.7

EFFECTS OF TRAINING ON UNEMPLOYMENT PROBABILITY:
NLS YOUNG MEN SAMPLE

A. Source of Training				
Training Variable	Regular School	Business and Technical School	Company Training	Other Sources
Current	-0.203 (0.200)	-0.056 (0.178)	0.256 ** (0.129)	0.412 *** (0.123)
Events	-0.128 (0.149)	0.071 (0.124)	-0.332 *** (0.099)	-0.357 *** (0.087)
Duration	0.018 (0.019)	-0.011 (0.016)	0.026 ** (0.012)	0.029 *** (0.010)

B. Type of Training				
Training Variable	Managerial	Professional and Technical	Semi-skilled Manual	Other Types
Current	-0.133 (0.247)	0.226 (0.154)	0.305 ** (0.127)	0.252 * (0.147)
Events	-0.120 (0.208)	-0.459 *** (0.124)	-0.159 * (0.081)	-0.224 ** (0.106)
Duration	0.001 (0.029)	0.039 *** (0.013)	0.013 (0.009)	0.021 (0.014)

SOURCE: NLS Young Men 1969, 1980.

NOTE: The probit results on which this table is based are reported in full in the appendix. Standard Errors of probit estimates in parentheses.

* Significant, from zero, at 10 percent level.

** Significant, from zero, at 5 percent level.

*** Significant, from zero, at 1 percent level.

We also analyzed the effects of training on the duration of unemployment for those currently unemployed or who had experienced a spell of unemployment over the past year. These results, reported in the Appendix, suggest that weeks unemployed are longer for those unemployed workers with less than a high school degree, are shorter for workers in the South, are shorter for workers with more job tenure, and are longer when the national monthly unemployment rate (averaged over 12 months) is high. However, the effects of training are very imprecisely estimated, largely because of the small sample of unemployed workers in any given period, so that any statements of relationships would be correspondingly tentative. Therefore, we simply conclude that we cannot find any significant effect.

V. SUMMARY AND CONCLUSIONS

We have used reported training measures taken from five surveys--the CPS, three cohorts from the NLS, and the EOPP--to paint a broad picture of post-school training in the United States. We have sought to answer the question of who gets training, how much, and why, and the effect of training on earnings and employment. In this section, we summarize the main findings on the determinants of training and its effects, highlight questions they raise, and discuss areas where future research will be most useful in guiding training policy.

Our use of reported training measures represents an important departure from the traditional reliance in the literature on alternative proxies for training, such as work experience and job tenure. The focus on these latter proxy variables, though important in testing different theories, has nonetheless precluded a better understanding of the empirical correlates of training and its effects, which can come only from actual measures of training received. Our report confirms that only the more formal kinds of training tend to be reported, but that they appear to be reported consistently. In fact, our results using these measures are remarkably consistent, despite the different types of information covered by the data sources, the different time intervals that they reflect, and the different groups of workers that they include.

What they reveal about training deserves special emphasis. On the most general level, they suggest that highly aggregated descriptions of training miss important differences among various sources and types of training, their determinants, and their consequences for earnings and employment. There is not one kind of training, but various kinds for different purposes. Some kinds of training are relevant in the context of technological change, and some are not. Some actively complement formal schooling, and some do not. The various kinds of training also have different effects on earnings and the likelihood of unemployment, and some effects persist longer than others.

The gross data in Sec. II revealed several aggregate differences across the various groups in the amounts and kinds of training received. First, both young men and career women in the NLS get more training than mature men, but women receive proportionately less company training than either of the other two male cohorts. In contrast, employed men and women in the CPS report get roughly similar amounts and kinds of training. The absence of any sex differences here may simply reflect sample selection (employed individuals), the age composition of the different samples, or other variables that we have not controlled for. Finally, compared with these populations, the economically disadvantaged EOPP sample get the least training, especially from company sources. Their training experience most closely resembles that of women with weak attachment to the labor force.

In Sec. III, we inquired into these differences by analyzing the determinants of training in each group. We estimated probit models relating training by source and by type to a comprehensive set of covariates. These included controls for variables such as educational attainment, worker characteristics, labor market experience, the industry rate of technical change, and local and national labor market conditions.

This analysis confirmed the importance of formal schooling as a determinant of post-school training. For both men and women, and for the economically disadvantaged group as well, the likelihood of getting most kinds of training rises with the level of educational attainment, except for the most highly educated group (those with postgraduate degrees). This suggests that both sources of "training" are strongly complementary. However, the quantitative importance of schooling varies. Compared with men, increased schooling among women is associated with a relatively smaller increase in company training and a larger increase in training from other sources. For the disadvantaged sample, the effects of schooling on the likelihood of training is smaller in all cases when compared with other groups in the population.

Formal schooling also plays an important role in getting the current job. The postgraduate group, in particular, is significantly more likely to report formal schooling as important over other

alternative sources of training. Possibly because the job-related content of their schooling is already high, postgraduates tend to get less of other kinds of training while working. The exceptions are those employed in high-tech industries, where formal school training may be less pertinent to the requirements of new technologies. In those firms, this group receives significantly more company and informal training, and are more likely to report OJT from prior jobs as being needed to get the current job.

These results are part of an overall pattern of skill requirements accompanying technological change found throughout the report. As the rate of technological change quickens, the probability increases of getting managerial training and training from in-house sources such as company programs or informal on-the-job training (OJT), especially for employees with more education. In contrast, the likelihood of getting professional, technical, and semiskilled manual training, or training from external sources such as business, technical, and traditional schools, falls as the rate of technological change quickens. These results confirm what has hitherto only been speculation, namely, that rapid technological change leads to increased reliance on in-house training, possibly because technology-specific skills are not readily available elsewhere, and to greater demand for highly skilled and educated employees, who may adapt more readily to new technologies.

These results provide insights into a related issue of how transferable skills are across jobs. We find that prior work skills are less important when new jobs are found in industries characterized by high rates of technological change. In contrast to the earlier finding, both men and women working in high-tech industries are significantly less likely to report that previous company training and OJT was important in getting the current (or last) job. An exception, as we have already noted, is postgraduates, for whom previous informal OJT is important. Their OJT may embody many noncodified kinds of technical and managerial skills not taught in traditional schools but important, nonetheless, for technological progress in new jobs.

The probability of getting training is affected by economic conditions, but in ways that differ depending upon whether cross-sectional or panel data are used. First, in the cross-section, the

likelihood of getting most kinds of training is depressed in local labor markets characterized by persistently high unemployment rates or greater cyclical volatility relative to the nation as a whole. We suspect that layoffs are more common in such states, possibly because employment is overrepresented in declining industries or in firms with volatile product demand. Employers and workers therefore have few incentives to provide or get training, since the likelihood of recouping training costs is low. Second, using time-series data, we find that periods of high national unemployment are associated with a greater likelihood of training from company sources, especially professional and technical types of training, for career women and mature men but not for youth. One possible interpretation is that employers retrain older workers during periods of slack economic activity when the opportunity cost of their time is low.

Training propensity might be expected to vary over the life-cycle, and it does. The likelihood of getting most kinds of training is low in the first five years in the labor market, coinciding with an initial period of job search. In the absence of job attachment, this likelihood continues to fall over time but at a lower pace; however, the likelihood of training rises with time on the job. The implication of these results is that those who work intermittently or change jobs frequently receive less training over the life-cycle.

Interestingly, when we control for observable worker attributes, nonwhite males are significantly less likely to get most kinds of post-school training, while race differences are not apparent among females. In fact, nonwhite females tend to get more training, though the differences are generally not statistically significant. These differences in training offer one possible explanation for observed earnings differentials among white and nonwhite males, and the absence of race differences among females noted in the literature.

In Sec. IV we investigated the effects of training on subsequent labor market outcomes of men. We estimated earnings models both with and without measures of reported training, and probit specifications for [illegible]lihood of unemployment. Large differences in the effects of training on earnings, earnings growth, and unemployment were found, depending upon the source or type of training. Many of these results

are consistent with, and may explain, the determinants of training found earlier to be important.

For example, earnings are observed to rise with the level of schooling completed in industries experiencing rapid technical change, especially for people with bachelor or postgraduate degrees. Earlier, we had hypothesized that better educated workers are more adept at responding to technical change, and therefore are more productive in high-tech firms. Supporting evidence for this "allocative efficiency of schooling" hypothesis was found in the greater likelihood of in-house training among the most educated workers in high-tech industries and, here, in their higher productivity and earnings.

The effects of training on earnings and earnings growth vary by source and by type. Among the different sources of training, company training has the greatest quantitative effect on increasing earnings, persisting for over 13 years. The effects of training from other sources are much smaller and persist for 8 to 10 years. When types of training are considered, managerial training increases earnings the most, but its effects are less enduring (12 years) than the effects of semiskilled manual training (15 years).

The effects of training on reducing the likelihood of unemployment mirror the earnings-augmenting effect of training. On average, training is associated with a subsequent decline in the likelihood of unemployment lasting approximately 12 years. Of all the sources of training, company training is most enduring (12.8 years), while the effects of training from regular school sources disappear within 7 years. Variations in these effects are also found across training types. Professional and technical training reduces the likelihood of unemployment the most, but because this attenuates rapidly over time, its effects persist only over 11.8 years. In contrast, managerial training did not have a significant effect on unemployment. The absence of any effect may simply reflect different (and offsetting) influences of training on increasing the trained manager's value both to the firm and to other employers, but this is speculation.

Finally, unlike the previous result for earnings, the industry rate of technological change in the current (or last) job is not statistically correlated with the probability of experiencing an

unemployment spell in the past year. In fact, for the sample of male youth studied, a higher rate of technological change is typically associated with a lower probability of unemployment, and for high school graduates, this relationship is statistically significant. At least for this group of youth, the results suggest that concern over the labor displacement effects of technological change may be misplaced. Whether or not this finding holds for other groups is a subject for future research.

In this report, we have developed rough estimates of the amounts of training received by different groups, and taken an important first step in identifying the major determinants of training and its effects on labor market outcomes. However, many important questions are raised by several research findings:

- The complementarity between formal schooling and post-school training. What kinds of training acquired in traditional schools are most likely to be useful in subsequent work? Do school curricula--vocational versus college preparatory coursework--matter for the kinds of training received on the job?
- The relationships between technological change, schooling, and skill requirements. What are the training needs (skill shortages) of different industries, and can policies be developed to encourage greater investments by employers and other providers in skills required for technological change?
- The relationship between training and local labor market conditions. Which states have persistently high unemployment rates or high cyclic volatility in unemployment relative to the nation, and why?
- Race differences in training propensity among males, and the absence of any differences between males and females. What factors account for these differences? To what extent has increased training contributed to the narrowing of the earnings gap between the ethnic groups, and between white and nonwhite women? How have trends over time in the training received by racial minorities changed?

- The relationship between training and labor force attachment. To what extent do women's skills obsolesce when they withdraw from the labor force? What kinds of training or retraining would facilitate their reentry?

APPENDIX

Table A.1

DETERMINANTS OF TRAINING TO GET CURRENT JOB AND IMPROVE SKILLS: CPS MEN

Variable	Training to Get Current Job			Training to Improve Job Skills		
	Company	OJT	Other	Company	OJT	Other
CONSTANT	-0.722 *** (0.089)	-0.167 ** (0.074)	-1.052 *** (0.099)	-0.969 *** (0.071)	-0.863 *** (0.067)	-2.193 *** (0.113)
SCHLT12	-0.447 *** (0.053)	-0.239 *** (0.037)	-0.304 *** (0.053)	-0.483 *** (0.059)	-0.076 * (0.046)	-0.392 *** (0.090)
SCH1315	0.186 *** (0.038)	0.143 *** (0.032)	0.105 ** (0.041)	0.229 *** (0.040)	0.102 *** (0.038)	0.317 *** (0.059)
SCH16	0.245 *** (0.044)	0.134 *** (0.037)	-0.120 ** (0.052)	0.478 *** (0.043)	0.116 *** (0.043)	0.552 *** (0.062)
SCH17P	-0.095 * (0.049)	-0.123 *** (0.038)	-0.291 *** (0.058)	0.308 *** (0.045)	-0.051 (0.046)	0.832 *** (0.057)
TCHLT12	-5.106 (4.469)	-4.213 (2.695)	-9.854 *** (3.798)	1.925 (4.539)	-1.200 (3.131)	2.822 (7.712)
TCH12	-4.980 ** (1.955)	-7.058 *** (1.725)	-3.202 (2.347)	0.408 (2.323)	5.525 *** (2.128)	-9.097 ** (3.800)
TCH1315	-5.512 ** (2.738)	-2.596 (2.337)	-7.850 ** (3.124)	2.878 (2.736)	-0.809 (2.823)	-0.306 (4.151)
TCH16	-6.472 ** (2.981)	0.520 (2.874)	3.005 (4.067)	3.561 (2.984)	-0.561 (3.358)	-3.261 (4.311)
TCH17P	-0.311 (4.894)	14.338 *** (3.632)	-2.083 (5.734)	15.322 *** (3.951)	6.632 (4.487)	-8.307 (5.411)
NONWHT	-0.103 ** (0.053)	-0.266 *** (0.041)	-0.203 *** (0.062)	-0.250 *** (0.056)	-0.012 (0.048)	-0.226 *** (0.085)
SOUTH	-0.041 (0.041)	-0.171 *** (0.033)	-0.118 *** (0.045)	-0.018 (0.042)	-0.074 * (0.039)	0.021 (0.058)
NE	-0.149 *** (0.048)	-0.181 *** (0.038)	-0.180 *** (0.055)	-0.127 ** (0.049)	-0.123 *** (0.047)	0.019 (0.066)
NC	-0.047 (0.042)	-0.180 *** (0.034)	-0.090 ** (0.045)	-0.054 (0.042)	-0.072 * (0.040)	0.182 *** (0.056)
UNION	0.235 *** (0.050)	-0.061 (0.044)	-0.041 (0.062)	-0.090 * (0.053)	-0.022 (0.050)	-0.243 *** (0.088)
E1ST5	-0.153 *** (0.041)	-0.290 *** (0.033)	-0.236 *** (0.046)	-0.132 *** (0.041)	0.016 (0.039)	-0.094 * (0.056)
POTEXP	0.000 (0.002)	0.001 (0.001)	0.003 (0.002)	-0.008 *** (0.002)	-0.010 *** (0.002)	0.002 (0.003)
TENURE				0.034 *** (0.003)	0.011 *** (0.002)	0.026 *** (0.003)
SELFEMP	-0.108 ** (0.049)	0.108 *** (0.038)	0.238 *** (0.047)	-0.296 *** (0.052)	-0.288 *** (0.050)	0.208 *** (0.056)
SHAT	3.417 (2.567)	-1.039 (2.067)	-3.049 (2.599)	-2.615 (2.488)	-5.977 ** (2.447)	-4.001 (3.352)
RHAT	0.030 (0.042)	-0.022 (0.034)	-0.147 *** (0.047)	-0.234 *** (0.042)	-0.136 *** (0.039)	-0.083 (0.059)
NUR	-0.055 *** (0.008)	-0.011 * (0.006)	-0.008 (0.009)			

* Significant, from zero, at 10 percent level.
** Significant, from zero, at 5 percent level.
*** Significant, from zero, at 1 percent level.

Table A.2

DETERMINANTS OF TRAINING TO GET CURRENT JOB AND IMPROVE SKILLS: CPS WOMEN

	Training to Get Current Job			Training to Improve Job Skills		
Variable	Company	OJT	Other	Company	OJT	Other
CONSTANT	-1.114 *** (0.110)	-0.447 *** (0.080)	-2.075 *** (0.160)	-1.086 *** (0.080)	-0.961 *** (0.073)	-1.698 *** (0.105)
SCHLT12	-0.228 *** (0.070)	-0.287 *** (0.048)	-0.092 (0.096)	-0.414 *** (0.076)	-0.095 * (0.055)	-0.568 *** (0.129)
SCH1315	0.119 *** (0.043)	0.131 *** (0.032)	0.236 *** (0.062)	0.242 *** (0.041)	0.081 ** (0.037)	0.103 * (0.056)
SCH16	0.055 (0.057)	0.057 (0.042)	0.252 *** (0.078)	0.373 *** (0.051)	0.099 ** (0.047)	0.410 *** (0.063)
SCH17P	-0.119 (0.074)	-0.020 (0.051)	0.174 * (0.096)	0.301 *** (0.061)	-0.116 * (0.062)	0.265 *** (0.098)
TCHLT12	-24.842 *** (6.595)	6.782 * (3.853)	-3.786 (8.168)	-23.692 *** (8.936)	2.337 (4.620)	-46.897 ** (20.172)
TCH12	-16.008 *** (3.140)	-3.469 * (2.055)	-4.424 (4.149)	-14.787 *** (2.824)	-2.191 (2.487)	-23.260 *** (4.239)
TCH1315	-9.553 ** (3.875)	-5.639 * (3.132)	-0.331 (5.649)	-5.505 (3.628)	-2.988 (3.636)	-13.579 *** (4.838)
TCH16	[illegible] (5.598)	6.514 (4.920)	7.717 (8.901)	0.091 (4.900)	2.282 (5.283)	4.687 (6.625)
TCH17P	[illegible] (10.039)	25.745 *** (7.046)	13.223 (11.348)	18.435 ** (8.170)	7.627 (9.927)	-27.000 (18.085)
NONWHT	-0.088 (0.058)	-0.076 * (0.040)	-0.080 (0.084)	-0.142 *** (0.054)	0.017 (0.045)	-0.270 *** (0.081)
SOUTH	0.007 (0.050)	-0.189 *** (0.036)	-0.048 (0.070)	-0.073 (0.046)	-0.076 * (0.041)	-0.173 *** (0.062)
NE	-0.156 *** (0.058)	-0.190 *** (0.042)	0.099 (0.083)	-0.176 *** (0.056)	-0.073 (0.050)	-0.300 *** (0.072)
NC	-0.102 ** (0.052)	-0.166 *** (0.037)	-0.105 (0.075)	-0.217 *** (0.048)	-0.047 (0.043)	-0.019 (0.058)
UNION	0.030 (0.075)	-0.110 ** (0.054)	0.012 (0.113)	-0.053 (0.068)	0.095 (0.060)	-0.175 * (0.100)
E1ST5	-0.122 ** (0.053)	-0.235 *** (0.038)	-0.074 (0.081)	-0.110 ** (0.050)	-0.081 * (0.044)	-0.181 *** (0.064)
POTEXP	-0.007 *** (0.002)	-0.000 (0.002)	0.006 * (0.003)	-0.004 (0.002)	-0.008 *** (0.002)	-0.003 (0.003)
TENURE				0.032 *** (0.003)	0.012 *** (0.003)	0.025 *** (0.004)
SELFEMP	0.225 *** (0.070)	-0.091 (0.055)	0.420 *** (0.081)	-0.176 ** (0.073)	-0.212 *** (0.069)	0.295 *** (0.075)
SHAT	3.533 (3.054)	-3.773 * (2.235)	-6.226 (4.045)	-0.629 (2.746)	-9.384 *** (2.659)	-4.183 (3.675)
RHAT	0.114 ** (0.050)	-0.018 (0.037)	-0.324 *** (0.066)	-0.199 *** (0.048)	-0.089 ** (0.043)	-0.067 (0.059)
NUR	-0.027 ** (0.010)	0.010 (0.007)	0.029 (0.013)			

* Significant, from zero, at 10 percent level.
** Significant, from zero, at 5 percent level.
*** Significant, from zero, at 1 percent level.

Table A.3

DETERMINANTS OF TRAINING FOR NLS YOUNG MEN, BY SOURCE AND TYPE

	Source of Training			Type of Training			
Variable	Company	Business/ Technical	Other	Managerial	Professional/ Technical	Semiskilled	Other
CONSTANT	-1.410 *** (0.108)	-1.468 *** (0.210)	-1.323 *** (0.107)	-2.059 *** (0.157)	-1.470 *** (0.103)	-1.132 *** (0.114)	-1.599 *** (0.121)
SCHLT12	-0.437 *** (0.068)	-0.522 *** (0.084)	-0.385 *** (0.068)	-0.449 *** (0.122)	-0.697 *** (0.095)	-0.451 *** (0.064)	-0.245 *** (0.069)
SCH1315	0.301 *** (0.046)	0.047 (0.054)	0.186 *** (0.047)	0.344 *** (0.069)	0.380 *** (0.049)	-0.114 ** (0.047)	0.272 *** (0.050)
SCH16	0.454 *** (0.054)	-0.229 *** (0.072)	0.203 *** (0.057)	0.620 *** (0.076)	0.705 *** (0.054)	-0.776 *** (0.077)	0.237 *** (0.061)
SCH17P	0.261 *** (0.054)	-0.066 (0.062)	0.360 *** (0.052)	0.501 *** (0.074)	0.952 *** (0.051)	-1.047 *** (0.085)	0.211 *** (0.059)
TCHLT12	4.250 (4.621)	18.005 *** (5.364)	7.035 (5.431)	9.938 (10.018)	9.914 (7.361)	15.638 *** (4.486)	-3.021 (4.267)
TCH12	1.250 (2.465)	-4.796 * (2.715)	-5.062 * (2.620)	-1.498 (4.524)	-2.545 (2.699)	-4.675 ** (2.221)	-0.987 (2.843)
TCH1315	0.283 (2.583)	-3.219 (3.124)	-7.542 ** (2.956)	5.064 (3.709)	-3.153 (2.746)	-9.867 *** (2.909)	-1.972 (2.807)
TCH16	9.866 *** (3.357)	-6.554 (4.820)	-8.612 * (4.624)	10.435 ** (4.931)	-6.851 ** (3.353)	4.132 (4.850)	-0.867 (4.424)
TCH17P	16.877 *** (3.462)	0.302 (4.550)	-13.354 *** (4.305)	20.738 *** (4.235)	-10.974 *** (3.428)	-0.018 (6.630)	-4.315 (4.121)
NONWHT	-0.168 *** (0.044)	0.041 (0.051)	-0.136 *** (0.046)	-0.210 *** (0.068)	-0.120 *** (0.046)	0.037 (0.046)	-0.176 *** (0.048)
SOUTH	-0.002 (0.034)	-0.003 (0.043)	-0.049 (0.036)	-0.012 (0.046)	-0.051 (0.035)	-0.052 (0.040)	-0.014 (0.037)
UNION	-0.064 (0.056)	-0.125 * (0.071)	-0.049 (0.058)	-0.224 *** (0.085)	-0.120 ** (0.061)	0.030 (0.059)	-0.030 (0.061)
POTEXP	0.009 ** (0.004)	-0.018 *** (0.005)	-0.005 (0.004)	-0.013 (0.077)	-0.003 (0.005)	-0.019 *** (0.005)	-0.000 (0.005)
E1ST5	0.002 (0.055)	0.023 (0.067)	-0.045 (0.056)	0.021 *** (0.006)	0.021 (0.054)	0.067 (0.064)	-0.003 (0.059)
CHGJOB	-0.184 *** (0.037)	0.155 *** (0.044)	0.023 (0.037)	-0.196 *** (0.051)	-0.022 (0.037)	0.029 (0.042)	-0.020 (0.039)
SCHWK	0.089 ** (0.039)	0.056 (0.050)	-0.048 (0.040)	-0.013 (0.017)	0.021 (0.040)	0.062 (0.044)	0.071 * (0.042)
SCHWKT	-0.044 (0.060)	0.139 ** (0.068)	0.141 ** (0.058)	0.072 (0.056)	0.155 *** (0.055)	0.115 * (0.068)	0.057 (0.062)
NUR	-0.002 (0.012)	0.011 (0.013)	0.007 (0.012)	0.042 (0.081)	0.015 (0.010)	0.010 (0.013)	0.007 (0.013)

SOURCE: NLS Young Men, 2-year intervals.
NOTE: Standard errors of probit specifications in parentheses.
* Significant, from zero, at 10 percent level.
** Significant, from zero, at 5 percent level.
*** Significant, from zero, at 1 percent level.

Table A.4

DETERMINANTS OF TRAINING FOR NLS MATURE MEN, BY SOURCE AND TYPE

Variable	Source of Training			Type of Training		
	Company	Business/ Technical	Other	Manager	Professional/ Technical	Other
CONSTANT	-0.599 ** (0.260)	-1.499 *** (0.497)	-0.229 (0.229)	-1.371 *** (0.512)	-0.595 ** (0.262)	-0.884 *** (0.301)
SCHLT12	-0.331 *** (0.070)	-0.154 (0.172)	-0.285 *** (0.056)	-0.363 *** (0.091)	-0.409 *** (0.070)	-0.289 *** (0.076)
SCH1315	0.190 ** (0.079)	0.177 (0.191)	0.279 *** (0.069)	0.136 (0.100)	0.373 *** (0.078)	0.174 * (0.090)
SCH16	0.106 (0.113)	0.547 *** (0.191)	0.401 *** (0.087)	0.242 * (0.125)	0.565 *** (0.094)	0.057 (0.127)
SCH17P	-0.076 (0.108)	0.047 (0.285)	0.635 *** (0.079)	0.038 (0.126)	0.808 *** (0.086)	-0.088 (0.126)
TCHLT12	0.767 (3.720)	6.104 (11.073)	-0.554 (2.941)	6.618 (4.901)	-6.983 (5.385)	-4.835 (3.877)
TCH12	-5.976 (4.[illegible])	8.708 (9.873)	-3.273 (4.136)	-1.184 (5.989)	-11.809 ** (4.931)	-5.161 (5.592)
TCH1315		-6.039 (11.804)	-17.600 *** (5.263)	-3.662 (8.691)	-11.630 ** (4.544)	-20.667 ** (9.378)
TCH16	[illegible]	-17.591 (24.302)	-15.266 ** (7.075)	-3.528 (11.015)	-16.202 ** (6.962)	-6.894 (10.507)
TCH17P	32.111 *** (7.226)	-16.564 (25.753)	-5.786 (6.792)	34.462 *** (8.138)	-11.501 (7.520)	9.319 (10.053)
NONWHT	-0.223 *** (0.069)	0.054 (0.183)	-0.029 (0.052)	-0.177 ** (0.087)	-0.181 ** (0.073)	0.022 (0.073)
SOUTH	-0.031 (0.055)	-0.007 (0.147)	0.036 (0.045)	0.069 (0.065)	0.044 (0.053)	-0.094 (0.066)
UNION	-0.589 *** (0.168)	-0.178 (0.195)	-0.239 (0.160)	0.216 (0.431)	-0.367 ** (0.173)	-0.506 ** (0.208)
POTEXP	-0.016 *** (0.005)	-0.027 ** (0.013)	-0.025 *** (0.004)	-0.028 *** (0.007)	-0.021 *** (0.005)	-0.013 ** (0.006)
NUR	0.014 *** (0.005)	0.014 (0.015)	0.013 *** (0.004)	0.008 (0.006)	0.023 *** (0.005)	-0.001 (0.006)
TENURE	0.004 * (0.002)	-0.015 *** (0.006)	-0.007 *** (0.002)	0.007 ** (0.003)	-0.005 ** (0.002)	-0.006 *** (0.002)

SOURCE: NLS Mature Men, 2-year intervals.
NOTE: Standard errors of probit specification in parentheses.
* Significant, from zero, at 10 percent level.
** Significant, from zero, at 5 percent level.
*** Significant, from zero, at 1 percent level.

Table A.5

DETERMINANTS OF TRAINING FOR NLS CAREER WOMEN, BY SOURCE AND TYPE

	Source of Training			Type of Training			
Variable	Company	Business/ Technical	Other	Managerial	Professional/ Technical	Clerical	Other
CONSTANT	-1.794 *** (0.354)	-1.974 *** (0.701)	-0.921 *** (0.213)	-2.423 *** (0.509)	-1.628 *** (0.276)	-1.181 *** (0.374)	-1.428 *** (0.272)
SCHLT12	-0.232 (0.179)	0.418 (0.378)	-0.270 ** (0.106)	-2.510 (285.02)	-0.233 (0.167)	-0.628 *** (0.205)	-0.052 (0.135)
SCH1315	0.236 * (0.135)	0.248 (0.369)	0.376 *** (0.091)	0.086 (0.188)	0.654 *** (0.110)	-0.186 (0.151)	0.238 * (0.125)
SCH16	0.058 (0.209)	0.312 (0.622)	0.893 *** (0.140)	0.211 (0.273)	1.053 *** (0.156)	-0.383 (0.383)	0.595 *** (0.173)
SCH17P	-0.067 (0.245)	-0.224 (7.612)	1.105 *** (0.265)	0.631 ** (0.252)	1.227 *** (0.231)	-0.973 (1.400)	-0.693 (1.261)
TCHLT12	-15.968 (12.218)	-14.184 (34.298)	-16.084 ** (7.314)	-4.090 (231.742)	-31.436 ** (15.366)	-2.038 (17.723)	-10.864 (8.241)
TCH12	-26.475 ** (10.210)	32.934 ** (15.941)	-17.349 *** (5.726)	-52.363 *** (14.528)	-30.165 *** (8.128)	1.921 (7.677)	-19.201 * (9.976)
TCH1315	12.051 (11.649)	11.019 (57.907)	-11.984 (8.478)	28.358 * (17.170)	-5.956 (9.096)	5.806 (14.017)	-9.776 (12.378)
TCH16	60.916 ** (30.968)	-0.144 117.136)	-27.543 (21.719)	76.039 (56.766)	-19.942 (21.828)	-0.569 (92.703)	12.956 (28.447)
TCH17P	80.704 *** (26.109)	-66.865 (682.919)	-97.568 * (55.354)	175.313 *** (14.685)	-51.023 (43.448)	103.240 (81.936)	-332.356 278.987)
NONWHT	0.155 (0.132)	0.250 (0.347)	0.138 * (0.080)	0.255 (0.197)	-0.024 (0.107)	-0.040 (0.147)	0.394 *** (0.102)
SOUTH	-0.059 (0.115)	0.197 (0.253)	-0.075 (0.078)	-0.215 (0.173)	-0.183 * (0.101)	-0.001 (0.124)	0.095 (0.102)
UNION	0.044 (0.213)	-0.014 (0.593)	-0.170 (0.135)	0.299 (0.268)	0.086 (0.149)	-0.206 (0.273)	-0.498 ** (0.223)
POTEXP	-0.029 ** (0.013)	-0.042 (0.033)	0.008 (0.008)	0.060 *** (0.021)	-0.028 *** (0.010)	-0.008 (0.013)	0.013 (0.011)
TENURE	0.024 ** (0.009)	0.002 (0.016)	-0.005 (0.006)	-0.006 (0.014)	-0.001 (0.007)	0.001 (0.010)	0.007 (0.007)
NUR	0.111 * (0.058)	0.040 (0.154)	-0.083 ** (0.035)	-0.231 *** (0.088)	0.148 *** (0.045)	-0.069 (0.061)	-0.163 *** (0.047)

SOURCE: NLS Mature Women, 1-year intervals.
NOTE: Standard errors of probit specification in parentheses.
* Significant, from zero, at 10 percent level.
** Significant, from zero, at 5 percent level.
*** Significant, from zero, at 1 percent level.

Table A.6

SUMMARY STATISTICS FOR THE NLS YOUNG MEN SAMPLE

Variable	Variable Description	Mean	Std. Dev.
LOGY	Logarithm annual earnings	9.0628	0.8858
LOGWW	Logarithm of weekly wages	5.2166	0.7753
YR69	Year dummy 1969	0.1901	0.3924
YR73	Year dummy 1973	0.2189	0.4135
YR75	Year dummy 1975	0.2126	0.4091
YR78	Year dummy 1978	0.1922	0.3941
NONWHT	Black	0.2324	0.4223
SCHLT12	Schooling < 12 years	0.1587	0.3654
SCH1315	Schooling 13-15 years	0.2479	0.4318
SCH16	Schooling 16 years	0.1200	0.3249
SCH17P	Schooling > 16 years	0.1550	0.3619
POTEXP	Potential work experience	9.6115	5.5028
EXPSQ	Experience squared	122.6614	125.1492
FIST5	First 5 years in labor market	0.2688	0.4433
TENURE	Years of job tenure	3.4448	3.8712
TENSQ	Tenure squared	26.8520	50.1881
TENMISS	Tenure missing	0.0312	0.1740
SOUTH	South	0.3980	0.4895
UNRATE	Local unemployment rate	5.1896	3.4692
URMISS	Unemployment rate missing	0.1735	0.3787
	Technical change interactions		
TCHLT12	Schooling < 12 years	0.0004	0.0047
TCH12	Schooling 12 years	0.0013	0.0067
TCH1315	schooling 13-15 years	0.0008	0.0055
TCH16	Schooling 16 years	0.0003	0.0037
TCH17P	Schooling > 16 years	0.0000	0.0035
OCCTRN	Any training current period	0.2903	0.4539
SOCCTR	Cumulated any training	1.3015	1.5799
DOCCTR	Duration any training	6.4756	10.4335
	Current period training		
COTRN	Company training	0.1038	0.3051
BTVTRN	Business/vocational	0.0478	0.2134
RSTRN	Regular school	0.0464	0.2103
OTHSCH	Other sources	0.0891	0.2850
MANTRN	Managerial	0.0378	0.1908
PROTRN	Professional/technical	0.1053	0.3069
SSMTRN	Semiskilled manual	0.0667	0.2496
OTHTYP	Other types	0.0657	0.2478
	Cumulated training		
SCOTR	Company training	0.4309	0.9299
SBVTR	Business/vocational	0.2099	0.5750
SRSTR	Regular school	0.2041	0.5342
SOTHS	Other sources	0.4461	0.8150
SMAN	Managerial	0.1497	0.5225
SPROTR	Professional/technical	0.4614	0.9033
SSSMTR	Semiskilled manual	0.3782	0.8602
SOTYP	Other types	0.2746	0.6061
	Duration of training		
DCOTR	Company training	2.0987	5.7908
DBVTR	Business/vocational	1.0430	3.6320
DRSTR	Regular school	0.9825	3.2163
DOTHS	Other sources	2.3098	5.3080
DMAN	Managerial	0.6967	3.0628
DPROTR	Professional/technical	2.3177	5.6222
DSMTR	Semiskilled manual	2.0423	5.7468
DOTYP	Other types	1.3379	3.7549

Table A.7

RESULTS FOR EARNINGS AND TRAINING
BY SOURCE AND TYPE: NLS
YOUNG MEN SAMPLE

	Source of Training		Type of Training	
Variable	Annual Earnings	Weekly Wages	Annual Earnings	Weekly Wages
INTERCEPT	8.728 (0.047)	5.146 (.042)	8.730 (0.047)	5.142 (0.042)
YR69	-1.022 *** (0.023)	-0.975 *** (0.020)	-1.021 *** (0.023)	-0.974 *** (0.020)
YR73	-0.594 *** (0.020)	-0.593 *** (0.018)	-0.599 *** (0.020)	-0.598 *** (0.018)
YR75	-0.429 *** (0.019)	-0.417 *** (0.017)	-0.437 *** (0.019)	-0.424 *** (0.017)
YR78	-0.172 *** (0.018)	-0.179 *** (0.016)	-0.170 *** (0.018)	-0.178 *** (0.016)
NONWHT	-0.228 *** (0.014)	-0.175 *** (0.012)	-0.228 *** (0.014)	-0.176 *** (0.012)
SCHLT12	-0.166 *** (0.019)	-0.167 *** (0.017)	-0.161 *** (0.019)	-0.161 *** (0.017)
SCH1315	0.074 *** (0.016)	0.055 *** (0.014)	0.076 *** (0.016)	0.058 *** (0.014)
SCH16	0.259 *** (0.020)	0.218 *** (0.018)	0.253 *** (0.021)	0.217 *** (0.018)
SCH17P	0.373 *** (0.019)	0.333 *** (0.017)	0.349 *** (0.020)	0.314 *** (0.017)
POTEXP	0.100 *** (0.006)	0.067 *** (0.005)	0.099 *** (0.006)	0.066 *** (0.005)
EXPSQ	-0.003 *** (0.000)	-0.002 *** (0.0002)	-0.003 *** (0.0002)	-0.002 *** (0.0002)
E1ST5	0.003 (0.024)	-0.027 (0.021)	0.005 (0.024)	-0.025 (0.021)
TENURE	0.091 *** (0.004)	0.052 *** (0.003)	0.092 *** (0.004)	0.053 *** (0.003)
TENSQ	-0.004 *** (0.000)	-0.002 *** (0.0003)	-0.004 *** (0.0003)	-0.002 *** (0.0003)
TENMISS	0.232 *** (0.032)	0.115 *** (0.029)	0.230 *** (0.032)	0.113 *** (0.029)
SOUTH	-0.096 *** (0.012)	-0.117 *** (0.011)	-0.096 *** (0.012)	-0.117 *** (0.011)
UNRATE	-0.002 (0.003)	0.0007 (0.002)	-0.002 (0.003)	0.001 (0.002)
URMISS	-0.054 ** (0.022)	-0.041 ** (0.020)	-0.052 ** (0.022)	-0.039 * (0.020)
TCHLT12	-1.970 (1.150)	-2.114 * (1.016)	-1.978 (1.152)	-2.124 * (1.018)
TCH12	-0.803 (0.836)	-2.143 *** (0.739)	-0.456 (0.835)	-1.803 ** (0.738)

Table A.7--continued

Variable	Source of Training: Annual Earnings	Source of Training: Weekly Wages	Type of Training: Annual Earnings	Type of Training: Weekly Wages
TCH1315	0.018	-0.945	0.178	-0.792
	(1.013)	(0.895)	(1.014)	(0.896)
TCH16	5.762 ***	4.648 ***	6.234 ***	5.088 ***
	(1.466)	(1.295)	(1.468)	(1.297)
TCH17P	7.118 ***	6.135 ***	7.967 ***	6.895 ***
	(1.543)	(1.364)	(1.542)	(1.362)
Regular School			Managerial	
Current	-0.046	-0.032	0.016	-0.006
	(0.039)	(0.034)	(0.046)	(0.040)
Events	0.082 **	0.061 **	0.166 ***	0.151 ***
	(0.031)	(0.027)	(0.035)	(0.031)
Duration	-0.010 **	-0.007 *	-0.014 **	-0.012 ***
	(0.004)	(0.004)	(0.005)	(0.004)
Company Training			Prof/Technical	
Current	0.000	-0.006	-0.011	-0.010
	(0.029)	(0.025)	(0.028)	(0.025)
Events	0.169 ***	0.147 ***	0.142 ***	0.110 ***
	(0.020)	(0.018)	(0.021)	(0.018)
Duration	-0.013 ***	-0.011 ***	-0.013 ***	-0.008 **
	(0.003)	(0.003)	(0.003)	(0.003)
Business/Vocational			Semiskilled Manual	
Current	-0.109 **	-0.089 **	-0.061 *	-0.040 *
	(0.038)	(0.034)	(0.031)	(0.028)
Events	0.119 ***	0.080 ***	0.096 ***	0.071 ***
	(0.029)	(0.025)	(0.020)	(0.018)
Duration	-0.013 ***	-0.008 **	-0.007 **	-0.003
	(0.004)	(0.004)	(0.003)	(0.002)
Other Sources			Other Types	
Current	-0.008	0.0008	-0.025	-0.010
	(0.028)	(0.025)	(0.033)	(0.029)
Events	0.088 ***	0.059 ***	0.101 ***	0.069 ***
	(0.020)	(0.017)	(0.026)	(0.023)
Duration	-0.009 ***	-0.005 **	-0.015 ***	-0.012 ***
	(0.003)	(0.002)	(0.004)	(0.003)

SOURCE: NLS Young Men.
NOTE: Standard errors in parentheses.
* Significant, from zero, at 10 percent level.
** Significant, from zero, at 5 percent level.
*** Significant, from zero, at 1 percent leve.

Table A.8

PROBABILITY OF UNEMPLOYMENT AND WEEKS UNEMPLOYED EQUATIONS BY SOURCE AND TYPE OF NLS YOUNG MEN

	Unemployment Probability		Weeks Unemployed	
Variable	Source	Type	Source	Type
INTERCEPT	-1.088 ***	-1.122 ***	-0.124	-0.085
	(0.103)	(0.103)	(0.193)	(0.192)
SCHLT12	0.143 **	0.141 **	0.209 *	0.211 *
	(0.067)	(0.067)	(0.113)	(0.112)
SCH1315	-0.101 *	-0.081	0.017	0.028
	(0.059)	(0.059)	(0.117)	(0.116)
SCH16	-0.469 ***	-0.423 ***	-0.261	-0.236
	(0.091)	(0.092)	(0.187)	(0.189)
SCH17P	-0.578 ***	-0.500 ***	-0.163	-0.171
	(0.081)	(0.083)	(0.164)	(0.164)
TCHLT12	-1.461	-1.370	3.329	2.306
	(4.191)	(4.187)	(6.778)	(6.749)
TCH12	-6.085 *	-5.517 *	-7.241	-8.710
	(3.220)	(3.189)	(5.924)	(5.881)
TCH1315	-4.400	-4.726	-9.799	-10.255
	(4.152)	(4.180)	(8.188)	(8.308)
TCH16	2.093	1.741	11.576	14.005
	(7.981)	(7.934)	(20.413)	(21.088)
TCH17P	-9.958	-11.152	-14.486	-11.644
	(7.375)	(7.492)	(19.221)	(19.275)
NONWHT	0.312 ***	0.312 ***	0.159 *	0.145
	(0.051)	(0.051)	(0.093)	(0.094)
SOUTH	-0.211 ***	-0.207 ***	-0.280 ***	-0.266 ***
	(0.048)	(0.048)	(0.093)	(0.093)
POTEXP	-0.002	-0.002	-0.005	-0.007
	(0.007)	(0.007)	(0.012)	(0.011)
E1ST5	0.147 **	0.151 **	0.082	0.053
	(0.069)	(0.068)	(0.134)	(0.133)
TENURE	-0.117 ***	-0.116 ***	-0.030 *	-0.031 *
	(0.007)	(0.007)	(0.016)	(0.016)
TENMISS	1.580 ***	1.563 ***	1.775 ***	1.749 ***
	(0.081)	(0.081)	(0.124)	(0.123)
NUR	0.096 ***	0.099 ***	0.193 ***	0.193 ***
	(0.018)	(0.018)	(0.033)	(0.033)

Table A.8--continued

Variable	Unemployment Probability		Weeks Unemployed	
	Source	Type	Source	Type
	Reg. School	Managerial	Reg. School	Managerial
Current	-0.203 (0.200)	-0.133 (0.247)	-1.027 ** (0.402)	0.072 (0.778)
Events	-0.128 (0.149)	-0.120 (0.208)	0.473 (0.322)	-0.535 (0.701)
Duration	0.018 (0.019)	0.001 (0.029)	-0.051 (0.038)	0.092 (0.114)
	Reg. School	Managerial	Reg. School	Managerial
Current	-0.056 (0.178)	0.226 (0.154)	-0.170 (0.365)	-0.395 (0.367)
Events	0.071 (0.124)	-0.459 *** (0.124)	0.221 (0.258)	0.335 (0.344)
Duration	-0.011 (0.016)	0.039 *** (0.013)	-0.056 * (0.031)	-0.046 (0.040)
	Reg. School	Managerial	Reg. School	Managerial
Current	0.256 ** (0.129)	0.305 ** (0.127)	-0.090 (0.285)	-0.258 (0.221)
Events	-0.332 *** (0.099)	-0.159 * (0.081)	0.035 (0.239)	0.213 (0.161)
Duration	0.026 ** (0.012)	0.013 (0.009)	-0.007 (0.026)	-0.033 * (0.018)
	Reg. School	Managerial	Reg. School	Managerial
Current	0.412 *** (0.123)	0.252 * (0.147)	-0.405 * (0.245)	-0.250 (0.352)
Events	-0.357 *** (0.087)	-0.224 ** (0.106)	0.253 (0.207)	-0.028 (0.296)
Duration	0.029 *** (0.010)	0.021 (0.014)	-0.028 (0.026)	0.006 (0.041)
TAU 2			0.593 *** (0.045)	0.590 *** (0.045)
TAU 3			1.093 *** (0.056)	1.088 *** (0.055)
TAU 4			1.558 *** (0.065)	1.554 *** (0.065)
TAU 5			1.952 *** (0.076)	1.949 *** (0.075)

SOURCE: NLS Young Men 1969, 1980
NOTE: Binomial or multinomial probit specifications.
Standard errors in parentheses
* Significant, from zero, at 10 percent level.
** Significant, from zero, at 5 percent level.
*** Significant, from zero, at 1 percent level.

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